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The relationship between information and the investor decision making process: An Exploratory Study

Thesis presented by:

Anthony Creed, Bsc

For the degree of MSc (Commerce)

University College Cork

Department of Business Information Systems

Head of Department: Professor Joseph Feller

Supervisors: Dr. John McAvoy, Prof. Phillip O'Reilly

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Declaration

This is to certify that the work I am submitting is my own and has not been submitted for another degree, either at University College Cork or elsewhere. All external references and sources are clearly acknowledged and identified within the contents. I have read and understood the regulations of University College Cork concerning plagiarism.

Acknowledgements

Following the completion of this thesis in the area of Financial Technology, I would like to acknowledge certain individuals. Firstly, the academic staff who assisted not only myself, but 11 other students to complete this masters. Specifically, my mentor and supervisor Dr. John McAvoy, who provided continual support throughout every stage of this thesis. Secondly, to my mentors and supervisors at StateStreet's office in Dublin whose financial support allowed me to complete this masters. To Yuri Yurgens, who provided direction to the industry report and the overall research area of Online Investing. Finally, I would like to thank my family who supported my decision to complete this degree and proved instrumental in its completion. Overall, this experience has been extremely rewarding. Learning about current technologies and being able to contribute to the world of academic research has been a positive experience.

Thesis Abstract

The investment landscape continues to evolve and grow across the globe. The new investor demographic are using new technologies and information sources to invest, while the availability of financial information has decreased the barriers that once existed to individual or retail investors. The advancement in financial technology (FinTech) has created new and unique ways of interacting with investment information and has opened multiple new ways of investing. However, there is uncertainty regarding what the future investing landscape will entail, from the technologies that will be used to the types of information that will be used. Reducing this uncertainty in the future of investing is critical for organisations that are looking to branch into these new emerging technologies. This thesis details research focused on the relationship between the investor and the information these investors use when making financial decisions. Multiple research methods were used throughout this thesis. These methods are Concept Centric Matrix (CCM), RepGrid Analysis, Key Informant Interviews, and Workshops. Each method was chosen to specifically address the relevant research question Looking into the future of the investing landscape involves first establishing a solid foundation on the present. The initial study sought to explore online investor behaviour in online social trading networks. This chapter of the thesis proposes an Investor Engagement Framework (IEF) to model the intention of investors to engage in social trading networks and identify the key information that investors rely on for engagement in copy trading. The next chapter focuses on the modality effect and how it can enhance an investor's financial decision-making process by providing both audible and visual financial information. The Amazon Echo Show was used to develop a Proof-Of-Concept (POC) that enabled the investigation of the modality effect. The final chapter examines the key trust factors of Twitter information when used for making financial decisions by millennial investors. This chapter focuses on the development of trust between an investor and the information they view on Twitter. All research carried out in this thesis was undertaken to investigate the overall relationship between the investor and the information they use to make financial decisions. The findings of this thesis revealed that investors valued transparent and verified financial information the most when making financial decisions and contributes to the body of knowledge in both Finance and IS as to how investors engage with online social investment and copy trading.

Chapter 1: Introduction

The following thesis is a compilation of the work I have completed while a student in the Statestreet Advanced Technology Centre in UCC studying for a research master' in the area of Financial Technology (FinTech).

Over the past 12 months I have researched Information and the Investors decision-making process. As well as my University College Cork supervisors, Dr. John McAvoy and Dr. Philip O'Reilly, I had an additional industry advisor from the State Street Corporation Mr. Juri Jurgens, their Global Head of Measurement. During my year of research, I was responsible for three research chapters. Two research chapters were completed as a collaboration with fellow students in the research centre with one chapter being an individual piece of research. All three studies explore the future of investing, focusing on the relationship between investors and the information they use to financial decisions.

1. Background to the study

Many financial services companies across the globe have set up research and innovation labs to aid in their development of upcoming technologies such as Blockchain, investment technologies and mobile payments. Such innovation centres include ING Katana Labs, Citigroup Innovation Labs, Barclays Eagle Labs, and VISA Innovation Centres (High, 2020). This of course includes the Statestreet Advanced Technology Centre set up in University College Cork in April 2016. The importance and dependence on Financial Technology has grown exponentially in the last number of decades and now is an integral part of our everyday lives (Haddad & Hornuf, 2019). FinTech is an exciting industry with some of the world's largest companies including Visa, PayPal, and Statestreet. The industry is changing and adapting constantly to keep up with new technology trends and developments. FinTech has created new applications, processes, products, and business models that have made some traditional banking and financial services completely redundant (Chen et al. 2017). The evolution from traditional banking to online services and electronic markets has vastly increased processing speed and the way in which business is conducted in the 21st century.

The investment ecosystem is constantly evolving. The method by which people invest has undergone a massive change since the creation of the internet. The people who invest have also changed; no longer is the only investor an institutional professional with years of experience. Young people, specifically millennials, are now beginning to invest at a younger age than ever before. This new generation of investors have near limitless access to investment information that was once only available to investment professionals. This information primarily comes in the form of social media with instantaneous updates using their smartphones. The future of investing however is still largely unknown. What new technology will investors use in the future and what information will they be using to make their decisions?
This research aims to investigate these questions and to investigate the relationship between the investor and the information they look at.

The objective of this research was to explore online investing and to better understand the relationship between the investor and the information they looked at. The main research questions that were investigated were;
Research Question 1: what draws investors to use online investing platforms such as Social Trading?
This question is examined in chapter 2, by creating a framework for investors engaging in social trading, a method of online investing.
Research Question 2: Through what information these investors are using to invest online?
Chapter 3 examines this question through the modality effect and the impact of the combination of visual and audible information for financial information.
Research Question 3: How online investors establish trust in the information they look at?
To answer this question, chapter 4 investigated how social media impacts on millennial investors development of trust in financial information?

2. Research Methods

This thesis consists of three research chapters each examining a different aspect of the relationship between the investor and the investment information they use. Multi-

method research is undertaken in this thesis, the value of this approach is described by Hammond (2005). He talks about multi-method research developing a fuller understanding of the research issue, which in this thesis is online investing. Each research method is described below in more detail in the relevant chapters

Literature review: Webster and Watson (2002)'s Concept Centric Matrix (CCM) method was used to conduct the literature reviews for chapters 2, 3, and 4. This literature review method was used due to its systematic approach to analysing literature which helped to identify key concepts. The backwards review allows the research to have a solid foundation on the research topic and to better establish a research gap. The forward review provided the most up-to-date literature on the research topic. The development of a CCM helped to understand what information investors were already interacting with and how, this provided a solid foundation for the answering of each research question.

RepGrid Analysis: The use of RepGrid analysis to collect primary data was chosen as the method provides a number of advantages. RepGrid interviews help to reduce bias, allow participants to interpret certain topics in a less restrictive way, and is a useful qualitative interviewing technique to gather unbiased information systems data. This RepGrid interview technique was used in chapter 3, focusing on the modality effect. RepGrid helped to answer this research question as it allowed each one-to-one interview to be focused on eliciting specific features and to create the requirements to accurately test Proof-Of-Concept in the context of the modality effect.

Key Informant Interviews: This primary data gathering technique requires interviewees to have a higher level of knowledge in the field being researched and are willing to communicate this knowledge. This method was effective in answering research question 2 because it allowed our choice of research participant to be more concentrated on knowledgeable investors which provided better results for the testing of information modality through the POC. The results from the key informant interviews were analysed and provided clarity regarding the modality effect and retail investors.

Workshops: This research method was chosen to collect primary data from millennial investors in chapter 4 which focuses on answering research question 3. Workshops allow more control of the data presented to participants, and to ensure all present for

the workshop are knowledgeable in the research domain which provides more accurate results. Each participant in the workshop was provided with financial information on Twitter and were required to make a financial decision using this information. The aim was to determine what leads these millennial investors to trust the information they were looking at. In trust and social media, the method helped address research question 3 by eliciting the key information points that millennial investors trust on social media.

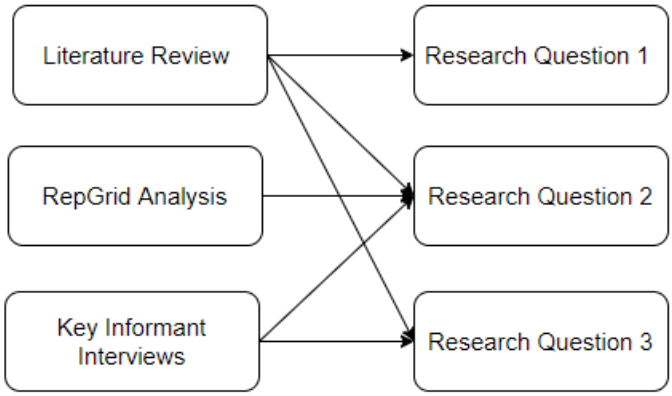

Figure 1: Methodologies used in this Thesis

3. State Street requirements

Along with the research that is presented in this thesis, additional research was conducted specifically for Statestreet, the sponsors of my Masters. An industry report and presentation of all work conducted were created for State Street staff. The industry report (see Appendix 2) detailed online investing and ultimately identified the research that would be undertaken for this thesis. This report discussed the evolution of the online investment landscape, current investing technology trends, and the future of investing. The industry report and presentation allowed a level of freedom when it came to the formation of opinions and reference sources. During the creation of the report, I was in close contact with my advisor in StateStreet, Yuri Yurgens, their global head of Measurement. He outlined the aspects to focus on and the elements of online investing that were important to him in his role in State Street. The primary investor that was to be examined was the millennial retail investor. A retail investor is a non-professional investor and generally used their own finance sources. We remained in continuous discussion throughout the masters program.

The industry report first looked at the dawn of online investing. The current online investing landscape was examined, and I identified the multitude of sources where Retail investors can get investment information. The next area examined in the industry report was emerging investors, the millennial investor demographic. Following this, the objective was to determine what information these investors will be using to invest and using what technology they will use to access it. This report found that Social trading platforms were emerging as a popular platform of investment, echoing the sentiment that will be described in detail in chapter 2 of this thesis. Environmental Social Governance (ESG) information was one example of the influence on millennial investors who are now seeking out ethical and sustainable investment opportunities. The technologies that millennial investors were beginning to use to search for investment information included Voice Assistants such as Amazon Alexa and Virtual Reality headsets. This report is discussed further in Appendix 2.

After the industry report was presented to StateStreet. I, along with the rest of my research team, presented the findings of both industry and academic research. In mid-September 2019, we presented to a large group of State Street staff and clients in their Dublin offices, with others videoconferencing to the event (the presentation can be seen in Appendix 2). The presentation focused on the research objective and the scope of the research - online investing and the impact of investment information. The presentation highlighted the benefit of the research undertaken to StateStreet and how they can use the research output in the future. My research team presented the POC developed during our research and demonstrated the capability of the Amazon Alexa Show. The POC showed to the State Street staff how the Voice assistant can be helpful to investors of the future. This functionality included providing text and audio information on a stock and being directed to the relevant websites if you want to invest.

4. My Contribution

The research undertaken in the chapters

Table 1. Thesis Format	
Chapter Title	Contribution
The Delegation of Investor Decision Making: What Drives Investors to Engage in Social Trading.	This chapter's framework helps researchers understand the drivers of online investors to engage in copy

	trading and delegate their investment decisions to others online.
Investor Decision Making: An Investigation of the Modality effect.	This chapter identifies that following further research and refinements, the inclusion of audible information to retail investment platforms is an area of significant potential.
Impact of Social Media on Trust in Millennial Investors	This chapter discusses how the number of followers a profile has and the number of retweets they gain per Tweet are the most important information for millennial investors when developing trust in the financial information provided on social media.

Table 1: Overview of Research Chapters in Thesis

These three chapters in Table 1 are based on the three research questions of the thesis. Each research question is asked as part of the overarching research objective of the thesis: understanding the relationship between information and the investor's decision-making process.

The second and third chapters of this thesis were completed as part of a research team with students from the State Street Advanced Technology Centre in UCC. In the second chapter on the modality effect and information presentation to online investors. responsibility for various sections was delegated amongst the three researchers. My contribution to this research project spanned all sections, with my primary focus on the methodology for literature review, signal provider trustworthiness, and the Framework discussion. Throughout the research, I also assisted in the development of the Investor Engagement Framework (IEF). For the third chapter, which focused on information modality for investment decisions, I assisted in the completion of all sections of the research but primarily focused on the RepGrid interviews, analysis, and the elicitation of system features. Chapter 4 focuses on social media and trust. All aspects of this chapter were conducted by me.

5. Research Journey – Reflective Perspective

Moving from a structured undergraduate course to a research masters was a challenging experience for me. The differences in timetable, readings and workload were all contrasting factors that varied from my first four years in college. I started to gain a better understanding of theoretical papers, researching in information systems sciences and knowledge theory. Talks with my supervisors, John and Phil, throughout the week started bringing me up to speed with the world of academic research. Adapting to higher levels of reading and self-motivated work was something which I struggled with in the beginning of the research masters. Individual work and interest were required from the very beginning while learning about new FinTech research areas. This was very different form working directly with lecturers, the module requirements, and a planned set of deadlines/projects from my undergraduate degree.

Throughout the 12 months, I was able to adjust to my new expectations for the research masters and learned a lot about researching, academic reading, writing conceptual and empirical papers, and conducting qualitative and quantitative research. I was able to develop new skills while improving many other previously held skills. My ability to read and analyse academic papers was very limited in the early stages. I found it difficult to take in so much information but, as the weeks progressed, I was able to take in more information and critically evaluate papers. Completing several short presentations during the course, I became more confident talking in front of Statestreet executives, our mentors, fellow students, and my supervisors. Overall, this research has been a challenging but rewarding experience for me.

6. Topic selection – Information and the Investor

My first area of research was Online Investing. Although I had a very basic understanding of the topic, I knew the key concepts and ideation behind the changing investor landscape. By attending talks on best practice for research and literature reviews, it gave me a basis to work from in getting the most out of reading and analysing pertinent articles, websites, and threads. I began researching millennial investors to gain a better understanding of the topic while searching for papers that specially discussed the idea of the future investor and what they will be investing in. After the first week of readings, I made a short presentation on my topic. I had a good basic understanding and was able to relay the issues and interesting points in that area.

Creating one of my first documents, I wrote and discussed the online investing ecosystem and the types of investments that can be made online.

Over the next few weeks, the research topic was narrowed toward online information access and how it would affect the investor decision making process. In November each student was tasked with preparing a power point presentation to present on front of the masters contingent, including the directors of the research centre, John and Phil. The aim of the presentation was to explain the basics of our individual research areas. By explaining it to other people, this helped me significantly in understanding my own topic. I was able to break down both the technologies and the types of investing that would impact the investor decision making process. This proved crucial in laying the groundwork for my research. After this exercise, I felt much more comfortable with my topic and was able to progress in my research in the coming days. This presentation helped me to be confident in creating research chapters based on the topic I would be studying in future months. Identifying a gap in the current literature was a key step in my research journey. Overall, I gained a detailed understanding of online investing, the different types of investments, the social aspects of investing and how it differs from traditional forms investing.

Following on from this presentation, two of my fellow researchers and I undertook research which would become chapter 2 in this thesis. The initial idea was to broadly search the area of online investing and conduct a literature review. This was quickly narrowed into the area of Social Trading as it was an innovative online investing method and one that was relatively new and unique. An analysis of the literature enabled our group to create a framework to develop an understanding of what information available on social trading platforms draws investors to engage in online investing with these platforms

Once the research for chapter 2 was completed. We continued our research by moving from investors using information in copy trading into how information is viewed. After conducting a literature review investigating how investors receive their information online, it was clear there was a research gap regarding investors and the modality effect. StateStreet provided access to the Amazon Alexa Show, which provided us with the technology which would become the core of a Proof of Concept (POC) based its multi-modal nature. The POC was developed over several weeks

based on the requirements determined though RepGrid key informant interviews. Once the POC was developed and tested, the research team was able to use it as the basis of our research into the modality effect.

When the research conducted by the research team was concluded, I undertook research which is now chapter 4 of this thesis. The initial idea was to investigate the different mediums of online investment information, which led to Social media and its relationship with millennial investor trust. After I conducted a literature review on trust and social media. I carried out workshops with millennial investors and captured the results using questionnaires. Once the data was analysed, conclusions were drawn from the workshops regarding trust and social media.

The next 3 chapters present the research undertaken to answer the three research questions, and ultimately achieve the research objective of investigating the relationship between information and the investors decision-making process.

Chapter 2: The delegation of investor decision making: What drives participants in social trading networks to engage in copy trading.

Abstract:
This study analyses existing literature to identify what drives participants in social trading networks to engage in copy trading. A concept-centric review of literature extracts recurring, relevant concepts and builds insights used to inform an Investor Engagement Framework which models the drivers of investor engagement in copy trading. It is considered that the underlying drivers of the Technology Acceptance Model alone aren't adequate in describing what drives social trading participants to engage in copy trading. The addition of affect-based signals and cognition-based signal augments the model to reflect trustworthiness in social trading networks. These results firstly outline that the Technology Acceptance Model needed to be extended when applied to the context of copy trading within social trading networks. Secondly, the results suggest that for a participant in a social trading network to engage in copy trading, the investor they copy must provide affect-based and cognition-based signals of trustworthiness.

1. Introduction

This chapter examines the first research question of what draws investors to use online investing platforms such as Social Trading. This is examined through the lens of social trading. Social trading networks are described by Wohlgemuth, Berger, and Wenzel (2016) as online communities in which investors can follow others and directly copy their investment decisions. The transparent nature of these networks has led to their quick growth in popularity (Glaser & Risius, 2018). Participants make investments based upon information gathered in online communities. Copy trading within these communities allows participants in the network to replicate others' trades (Doering, Neumann, & Paul, 2015). Copy trading investors are split into two separate categories: signal providers and followers. Signal providers are individual investors whose investment decisions are available for followers to track and analyse. Followers are also individual investors; however, they copy the investment decisions of signal providers. Copy trading allows for instant and automated replication of signal provider trades by followers; therefore this allows the delegation of the investment decision. Following signal providers allows followers to efficiently gather appropriate amounts of information in a cost-effective way. Essentially, by engaging in copy trading, investors avoid excessive analysis by identifying their preferred signal providers and copying their trades (Oehler, Horn, & Wendt, 2016). This study builds a framework which models the intention of participants in social trading networks to engage in copy trading.

The framework is based on an analysis of literature, from different domains, which discuss online trading, the growth of social trading networks, and the adoption of copy trading among retail investors (Barber & Odean, 2001b, 2002; Berger, Wenzel, & Wohlgemuth, 2018; Doering et al., 2015; Konana & Balasubramanian, 2005; Wohlgemuth et al., 2016). The framework created in this study is referred to as the Investor Engagement Framework (IEF). Monsuwé, Dellaert, and De Ruyter (2004)'s research in online consumers' adoption of e-commerce describes perceived utilitarian gains as *ease of use* and *usefulness* and describes perceived hedonic gains as *enjoyment*. This study builds on existing research, such as Konana and Balasubramanian (2005), which suggests that satisfaction among online investors is largely driven by perceived utilitarian gains and perceived hedonic gains. The framework in this study similarly categorises ease of use and usefulness with

utilitarian gains and categorises enjoyment with hedonic gains to extend Davis (1989)'s Technology Acceptance Model (TAM) to the context of online investing. Analysing existing literature highlighted that the core constructs of TAM alone are, at times, not sufficient in modelling user acceptance (Pikkarainen et al., 2004). This study's framework extends existing research by including signal provider trustworthiness (Wohlgemuth et al., 2016) as an extension of TAM in the context of copy trading. Signal provider trustworthiness is included as an exogenous factor to mediate the relationships between TAM's core constructs and investors' intentions to engage in copy trading.

The next section of the chapter addresses the methodology used to review and analyse relevant literature. Following that, the framework is introduced containing constructs that impact online investors' attitudes and intentions to engage in copy trading. The chapter then describes usefulness, ease of use, and enjoyment as basic determinants of online investor intentions. The next section of the chapter describes how signal provider trustworthiness mediates the relationship between usefulness, ease of use, and enjoyment and the intentions of online investors to engage in copy trading. The final section of the chapter discusses the findings of the study, future research avenues, implications for researchers and implications for practitioners.

2. Literature review methodology

In order to complete a comprehensive literature review, this chapter followed the guidelines and instructions of Webster and Watson (2002). The review specifically focuses on literature in the field of copy trading. The intention of this review is to propose a framework to accurately synthesize and extend the existing literature, shed light on avenues for future research, and ultimately provide practical implications within the area of copy trading. To fulfil this intention and provide a complete review of literature, concepts identified within existing literature are the focus of the study.

In order to identify the source material for the literature review, the major contributions from leading journals in the Information Systems field (generally referred to as the 'basket of eight' information systems journals) were examined. This basket consists of the European Journal of Information Systems, Information Systems Journal, Information Systems Research, Journal of AIS, Journal of Information Technology, Journal of MIS, Journal of Strategic Information Systems, and MIS

Quarterly. Within these journals, the table of contents were reviewed to identify and highlight articles within the scope of copy trading. From there, literature and journals from outside the information systems field were also examined and highlighted as important due to the interconnected nature of information systems with other disciplines. Journals such as European Financial Management, Journal of Business Research, Review of Financial Studies, Decision Support Systems, International Journal of Service Industry Management and Journal of Decision Sciences were also examined. In addition to the examination of each journal's table of contents, academic databases were used to efficiently filter and identify relevant articles. The databases examined included EBSCO, ProQuest, Science Direct, JSTOR and SSRN.

Step 1: Investigation of leading journals and journal databases:

The first step in reviewing existing literature involved searching relevant, leading journals and journal databases (Melville, Kraemer, & Gurbaxani, 2004). To generate initial keywords that would focus the literature search, several steps were carried out. These steps included writing a brief description of the research area that would generate an initial search of literature. From the initial literature that was examined, several core areas were continuously identified. These areas were the use of online platforms for investing, social influence in online trading, and the use of copy trading. The investigation of the basket of eight information systems journals used these core areas as keywords to identify relevant articles (Hamari, Koivisto, & Sarsa, 2014). These keywords could be added to or changed if necessary, as the creation of the concept centric matrix progressed. Searches were conducted in titles and abstracts of papers using the following keywords: 'online investing', 'online investors', 'online platforms', 'social trading', 'social influence in trading' and 'copy trading'. Following the search through titles and abstracts, each journal's table of content was examined to identify any relevant research not identified by the initial keyword search.

This was followed by an extended search using the same keywords outside the basket of eight and information systems field of literature. Searches were also conducted in titles and abstracts of papers using the same keywords as the above paragraph. If the title and abstract did not seem to be relevant to the research topic, they were excluded. Following the search through titles and abstracts, each journal's table of content was examined as per Webster and Watson (2002) to identify any relevant research not

identified by the initial keyword search. After reading of the table of contents, several papers were omitted from reading due to several factors. Papers that were non-peer reviewed, study design, type of publication, and study environment were not read further. The additional search through these journals allowed for the identification of additional literature relevant to copy trading. By searching this additional layer of journals, literature was found that allowed the review to more holistically synthesize existing literature within the boundaries of this study.

In total, following the searches of the basket of eight information systems journals and relevant additional journals mentioned above, 12 articles were identified within the field of copy trading. These 12 articles included only 1 article from within the basket of eight Information Systems journals. A likely explanation for this is the relatively recent emergence of literature in the field of copy trading. The extended search for literature outside the basket of eight accounted for the other 11 relevant articles identified. Following the analysis of each article's abstract, keywords, or the full article when necessary, 3 articles were deemed to be outside the scope of the research and were therefore excluded. The exclusion of these articles resulted in a total of 9 articles deemed relevant for an in-depth review.

Step 2: Backward review:

During this step, the citations in the articles identified in step 1 were reviewed to identify prior studies in the field of copy trading. Within these citations, the keywords: 'online investing', 'online investors', 'online platforms', 'social trading', 'social influence in trading' and 'copy trading' were once again used to identify relevant articles. Reviewing the citations of articles from step 1 facilitated the chronologically backwards investigation of articles within the scope of the review (Levy & Ellis, 2006). This identified the initial literature in the field of online investing and, more recently, copy trading. A further set of 18 articles from journals and conference proceedings other than those formally searched were collected. Each of these articles was reviewed in full.

Step 3: Forward review:

The third and final step involved using the Web of Science and Google Scholar to identify studies that cite the key articles identified in steps 1 and 2. Articles identified were searched using the keywords that had been used in previous paragraphs to further

refine the relevant articles. Reviewing the articles that cite those from step 1 and 2 facilitated the chronologically forward investigation of articles within the scope of the review (Levy & Ellis, 2006). This identified the more recent literature within the field of copy trading. A further set of 7 articles from journals and conference proceedings other than those reviewed in steps 1 and 2 were identified. Each of these articles was reviewed in full. In total, the 3 steps resulted in the full review of a set of 33 articles.

As per Webster and Watson (2002)'s guidelines, a concept-centric matrix was created using concepts from all articles identified in each of the 3 steps. Articles were reviewed in full and corresponding concepts were grouped. Concepts were then segregated by unit of analysis to keep each concept relevant and within the scope of copy trading. Articles referenced were grouped by concept. An example of the concept-centric matrix used is seen below in Table 2, which illustrates *usefulness* as a concept derived from the review of existing literature in copy trading. The 4 articles referenced are grouped by the concept *usefulness.* This concept is then isolated by *imitation*, *return on investment* and *risk management* as units of analysis. Once new concepts were not being extracted during the review of relevant articles, the review was deemed to be nearing completion with a relatively complete account of the relevant literature (Webster & Watson, 2002). The table intends to convey key findings and relationships from existing literature.

Concepts	**Unit of analysis**	**Number of citations**	**Papers**
Usefulness	Imitation	3	(Wohlgemuth et al., 2016), (Pan, Altshuler, & Pentland, 2012), (Berger et al., 2018).
	Risk management	4	(Berger et al., 2018), (Sharpe, 1964), (Markowitz, 1952), (Fama & MacBeth, 1973).
	Return on investment	10	(Barney, 1991), (Peteraf, 1993), (Berger et al., 2018), (Grahovac & Miller, 2009), (Jonsson & Regnér, 2009), (Madhok, Li, & Priem,

			2010), (Barber & Odean, 2000), (Barber & Odean, 2001b), (Barber & Odean, 2002), (Konana & Balasubramanian, 2005).
Ease of use	Transparency	5	(Glaser & Risius, 2018), (Stoughton, 1993)
	Experience level	5	(Barber & Odean, 2002), (Konana & Balasubramanian, 2005), (Singh, Sandhu, & Kundu, 2010), (Pentland, 2013), (Berger et al., 2018).
	Reduced overtrading	9	(Barber & Odean, 2000), (Barber & Odean, 2001b), (Barber & Odean, 2001a), (Barber & Odean, 2002), (Choi, Laibson, & Metrick, 2002) (Konana & Balasubramanian, 2005), (Anderson, 2007), (Berger et al., 2018), (Pelster, 2019).
	Reduced fees	6	(Barber & Odean, 2001b), (Konana & Balasubramanian, 2005), (Berger et al., 2018), (Glaser & Risius, 2018; Oehler et al., 2016), (Glaser & Risius, 2018), (Kromidha & Li, 2019).
Enjoyment	Self-attribution	4	(Konana & Balasubramanian, 2005), (Kahneman & Riepe, 1998), (Gervais & Odean, 2001), (Berger et al., 2018).
	Illusion of knowledge	4	(Konana & Balasubramanian, 2005) , (Barber & Odean, 2001b), (Barber & Odean, 2002), (Glaser & Risius, 2018).

	Illusion of control	3	(Langer, 1975), (Konana & Balasubramanian, 2005), (Barber & Odean, 2002), (Barber & Odean, 2001b).
Signal provider trustworthiness	Cognition-based signals	3	(McAllister, 1995), (Doering et al., 2015), (Wohlgemuth et al., 2016).
	Affect-based signals	4	(McAllister, 1995), (Pan et al., 2012), (Wohlgemuth et al., 2016), (Mesch, 2012).

Table 2: Concept-centric matrix.

3. Investor Engagement Framework core constructs

This study's framework intends to illustrate online investors' intention to engage in copy trading through the lens of previous research on consumer adoption of new technologies. As described above, the core constructs of the framework are adapted from TAM (Davis, 1989). While TAM has been used generally as a method to gauge a user's willingness to accept emerging technology, previous literature has validated TAM as a predictor of technology adoption in the context of online investing (Balasubramanian, Konana, & Menon, 2003; Konana & Balasubramanian, 2005). Therefore, TAM constructs are considered to be appropriate as an initial basis for this study's framework.

TAM identifies two determinants, according to previous research, that play an important role in people's acceptance or rejection of information technology. The first determinant referred to as *perceived usefulness,* describes how people tend to use or not use an application to the extent that they believe it will help them improve performance. The second determinant referred to as *perceived ease of use* describes how an application that is easy to use is more likely to be accepted. Therefore, in addition to perceived usefulness, usage is theorized to be influenced by perceived ease of use. To align the core constructs of this study's framework with the core constructs of TAM, perceived usefulness is defined as the degree to which a person believes that using copy trading would enhance their online trading performance. Similarly perceived ease of use is defined as the degree to which a person believes engaging in copy trading would be free of effort. Davis, Bagozzi, and Warshaw (1992) extend TAM with *enjoyment* as an additional basic determinant of technology user

acceptance. This study's framework includes enjoyment as a core construct as per this more recent version of TAM. During the study, enjoyment is defined as the extent to which copy trading provides satisfaction among investors, despite any negative impacts on investment performance. In summary, the three basic determinants of user acceptance within this study's framework are perceived usefulness, perceived ease of use and enjoyment. Throughout this chapter, these basic determinants will be referred to as the core constructs of the framework. Therefore, in a similar fashion to prior research based on online technology adoption (Konana & Balasubramanian, 2005; Monsuwé et al., 2004), this study's framework includes both utilitarian and hedonic basic determinants of investors' attitude towards copy trading. TAM core constructs are illustrated below in figure 2. The next section of the chapter extends TAM by examining each core construct and identifying the corresponding underlying drivers in the context of copy trading.

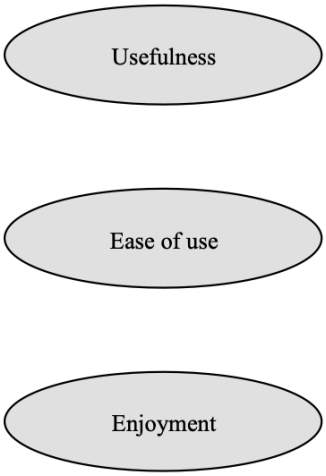

Figure 2: The core constructs of TAM

4. Underlying drivers of core constructs

This section of the chapter intends to discuss copy trading through the lens of TAM's core constructs of usefulness, ease of use and enjoyment. Each core construct is defined, applied to the context of a certain system and broken down into separate subcomponents referred to as underlying drivers of the core construct. While TAM and its core constructs are generally applied to user acceptance of emerging technology, this study considers TAM's core constructs as determinants of investors' adoption of copy trading. The following sections address each core construct and the corresponding underlying drivers in this context.

a. Usefulness

Perceived usefulness, as identified by TAM, plays an important role in a user's acceptance or rejection of new technology. Davis (1989, p. 2) escribes perceived usefulness as the extent to which people believe technology "will help them perform their job better". In the context of this study usefulness is defined as the degree to which an investor believes that by engaging in copy trading, they will improve their investment performance and outcomes. In this study's framework, three underlying drivers of the usefulness construct are identified as: imitation, return on investment and risk management, as illustrated by figure 3. The framework refers to these underlying drivers as key characteristics of usefulness in copy trading, each is explained separately below.

Imitation is facilitated by the copy trading functionality of social trading networks. Copy trading refers to "automatically, simultaneously, and unconditionally replicate other investors' trades" (Wohlgemuth et al., 2016, p. 1). This feature enables investors to imitate more experienced and competent investors and benefit from more profitable opportunities (Pan et al., 2012). Copy trading also allows for investors to bypass typical transactional costs and costs in gathering information, thus making it very attractive and practical for less-experienced traders. By engaging in copy trading, inexperienced investors can imitate other more experienced investors to realise higher returns from the beginning and subsequently develop knowledge and expertise (Berger et al., 2018). Enhancing investors' profitability through imitation aligns with the framework's definition of perceived usefulness in that imitation allows investors to enhance returns.

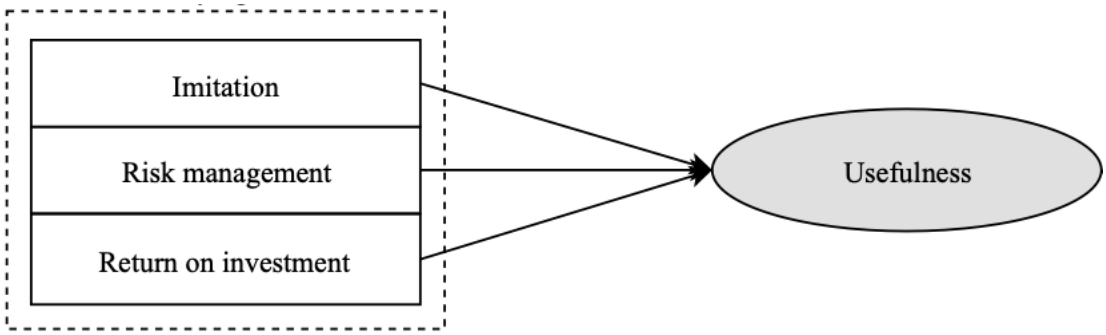

Figure 3: Usefulness underlying drivers.

Risk management in copy trading is highlighted by Berger et al. (2018) as playing a primary role in explaining performance outcomes. In investment contexts, risk refers to the potential for deviation of returns from expected outcomes (Sharpe, 1964). Previous literature identifies diversification as a primary method of investment risk mitigation (Markowitz, 1952). In tailoring a portfolio to a particular risk appetite, investors' decisions are considered to be influenced by the risk-return trade-off of a particular investment (Fama & MacBeth, 1973). Berger et al. (2018) describe how investors can build portfolios diversified by imitated investors in accordance with their own objectives and risk appetite. Signal providers are assigned a risk score by the social trading platform to portray their risk exposure to imitators. Imitators can then choose to imitate signal providers with risk scores aligning with their own preferences. The research of Berger et al. (2018) solidifies the idea that by identifying signal providers with similar risk appetites, followers can achieve improved returns via imitation. Therefore, risk management in a copy trading context aligns with the framework's definition of usefulness as the investor believes that copy trading could improve risk management via the diversification of signal providers, enhancing portfolio performance.

Return on investments in copy trading is primarily influenced by the resource-based view as described by Berger et al. (2018). Barney (1991, p. 1) and Peteraf (1993)'s resource-based view suggests that uniqueness among firms allows for "sustained competitive advantage". Their research also points out that inimitable resources are likely to produce increased returns; therefore, if competitors can imitate these resources, equally improved returns are realised. Existing literature also points out the significant cost of emulating and rearranging resources as barriers to imitation (Jonsson and Regnér (2009). In the context of copy trading platforms, inexperienced investors can undermine these barriers to imitation by avoiding typical transactional costs and costs in gathering information when imitating more experienced investors' trades. Early research in online investing discusses how overtrading causes online investors to underperform more traditional investment strategies (Barber & Odean, 2000, 2001b, 2002; Konana & Balasubramanian, 2005). Copy trading offers a solution to these inexperienced online investors by neutralising their lack of experience via imitation and realising returns comparable to those of more competent investors

(Berger et al., 2018). This aligns with the framework's definition of usefulness in that by engaging in copy trading, investors can enhance their returns.

In summary imitation, risk management and return on investment are enhanced by copy trading according to previous literature. This study's framework defines usefulness as the degree to which an online investor can enhance their investment performance. By incorporating the analysis of existing literature on online investing and copy trading, the framework suggests that imitation, risk management and return on investments are the foundational underlying drivers of perceived usefulness among investors in copy trading.

b. Ease of use

Perceived ease of use, as identified by TAM, plays an important role in a user's acceptance or rejection of new technology and is defined in this study as the ease with which investors can copy trades and realise improved returns. In this study's framework, four underlying dimensions of the ease of use core construct are identified and included: transparency (Glaser & Risius, 2018), experience level (Balasubramanian et al., 2003; Berger et al., 2018), reduced overtrading (Anderson, 2006; Barber & Odean, 2000; Choi et al., 2002) and reduced fees (Barber & Odean, 2001b; Berger et al., 2018; Glaser & Risius, 2018; Konana &

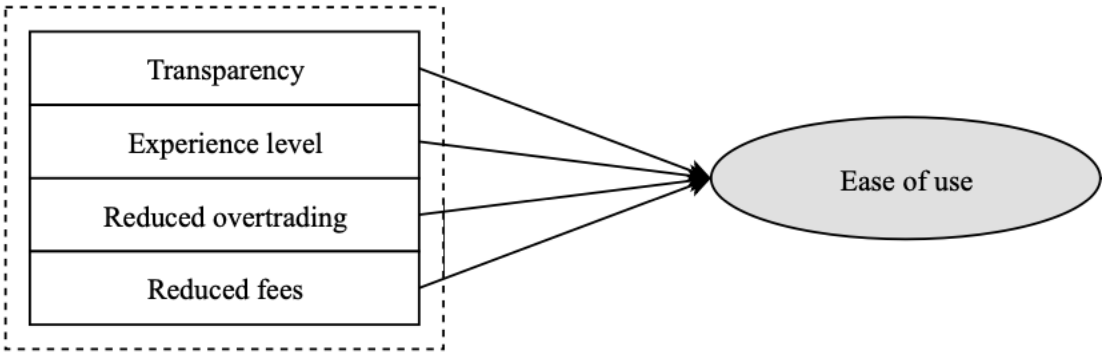

Figure 4: Ease of use underlying drivers.

Balasubramanian, 2005; Kromidha & Li, 2019; Oehler et al., 2016) as illustrated by figure 4. The framework refers to these underlying drivers as key characteristics of ease of use in online copy trading; each is described separately below.

Transparent social trading networks are becoming increasingly relevant as disintermediating platforms. Signal provider transparency in these networks combined with automated and immediate replication of their decisions allows for extensive control over investments (Glaser & Risius, 2018). The study of Stoughton (1993) highlights the bias of investment managers in prioritising their own profits over the underlying investor. A fundamental difference of copy trading to traditional investment manager-client relationships is the degree of transparency regarding signal provider decisions. In traditional delegated portfolio management, investors receive periodic updates on returns. Copy trading in comparison is fully transparent in that investors can see every decision made by signal providers in real-time. Due to the visibility of signal provider performance, followers can identify more competent investors with more conservative approaches, and in doing so, increasing their chance of improved returns (Glaser & Risius, 2018). The degree of transparency in copy trading platforms allows investors to easily choose a signal provider based on the information available, aligning with the framework's core construct, ease of use.

In terms of online investors' *experience level*, Barber and Odean (2002) point out that the democratization of information online means investors have access to data similar to investment professionals; however, a clear disparity with regard to experience level exists. Their study goes on to point out that the more overconfident an investor is, the more likely they are to overstate their experience level and ultimately the more likely they are to begin investing online. Overconfidence is then highlighted among these online investors who trade excessively resulting in subpar returns. The study ultimately suggests that rational investors would not engage in overtrading. Konana and Balasubramanian (2005) describe how, traditionally, competent brokers with superior knowledge are used to manage investments. Their study also identifies that overconfidence is evident among inexperienced investors; however, this overconfidence is corrected by experience. The work of Singh et al. (2010) highlights a disparity in experience level between adopters and non-adopters of investing online. However, the study goes on to identify that younger investors value information obtained online more than older, more experienced, investors. Ultimately, the study finds that inexperienced investors are more likely to adopt online investing. Existing research after the emergence of copy trading, such as Pentland (2013)'s study of the social trading platform eToro, reveals that followers who imitate investors with

diversified portfolios can achieve higher returns. This finding highlights that imitation can allow average or inexperienced investors to realise improved and in some cases above-average returns. Berger et al. (2018) further consolidate this finding by presenting empirical evidence that inexperienced investors can achieve returns comparable to those of experienced investors. Therefore the disparity in experience levels among online investors identified by Barber and Odean (2002), Konana and Balasubramanian (2005) and Singh et al. (2010) is somewhat bridged by copy trading and improved returns are realised with relatively lower levels of effort aligning with this framework's core construct of usefulness.

Overtrading as described above is a destructive attribute of overconfident online investors who trade excessively and therefore reduce returns (Anderson, 2007; Barber & Odean, 2000, 2001a, 2001b, 2002; Choi et al., 2002; Konana & Balasubramanian, 2005). Online investing reduces traditional costs associated with liquidity, transactions and commissions. However, Barber and Odean (2002) identify that increased speculation among investors online offsets these cost reductions. These speculative losses are a result of overconfident, irrational, investors. Copy trading has the potential to neutralise this irrationality. This is pointed out by the research of Berger et al. (2018) who propose that less competent, excessive traders can imitate more rational and competent traders, resulting in improved returns. The findings of Pelster (2019) highlight attention from peers and an increase in followers results in an increase in trading volumes; however, these volumes decrease in time. In summary, by identifying rational and more competent investors, less rational and less competent investors can delegate their decisions to signal providers and to a certain extent, reduce irrational overtrading. This reduction in irrational overtrading via copy trading requires a lower level of effort from investors to realise higher returns, aligning with this framework's core construct, usefulness.

Reduced fees are pointed out in early online investing literature by Barber and Odean (2001b) and Konana and Balasubramanian (2005) as a benefit for investors using disintermediated online platforms that significantly reduce the cost of executing trades and gathering investment information. However, overtrading stems partially from these reduced costs which, while lower per transaction, can accumulate with increased trading volume (Barber & Odean, 2001a). Copy trading has been identified as a method for less competent investors to imitate more rational investors and, therefore,

reduce irrational overtrading (Berger et al., 2018) and reduce costs accumulated from increased trading volume. In combination with rational trading volumes reducing costs, recent literature focusing on copy trading highlights cost efficiency with regard to transactions and acquiring information via copy trading (Glaser & Risius, 2018; Oehler et al., 2016). This observation is reiterated by Berger et al. (2018) who point out that costs in transacting and gathering information are incurred by the signal provider, not the follower. Kromidha and Li (2019) highlight the low cost of choosing between alternative signal providers. Generally, copy trading has proven to be cost-effective and free of significant effort relative to traditional investing. This aligns with the framework's core construct of usefulness.

In summary, based on an analysis of previous literature, copy trading's increased transparency, reduction of fees and reduction of overtrading among inexperienced investors allows for an investing experience that generally requires less effort than traditional methods. This study's framework defines ease of use as the ease with which investors can copy trades and realise improved returns as per TAM. By incorporating the analysis of existing literature on online investing and copy trading, the framework posits that transparency, experience level, reduced overtrading and reduced fees are the foundational underlying drivers of perceived ease of use among investors in copy trading.

c. Enjoyment

Enjoyment is an extension of TAM identified by Davis et al. (1992) which acts as an additional basic determinant of a user's acceptance or rejection of new technology. Enjoyment is defined during this study as the extent to which copy trading provides satisfaction among investors, despite any negative impacts on investment performance. In this study's framework, three underlying dimensions of the enjoyment core construct are identified and included: self-attribution, illusion of knowledge, and illusion of control (Anderson, 2006; Barber & Odean, 2000, 2001b, 2002; Konana & Balasubramanian, 2005; Looney, Valacich, Todd, & Morris, 2006; Uchida, 2006; Unsal & Movassaghi, 2001) as illustrated by figure 5. The framework refers to these underlying drivers as key characteristics of enjoyment for copy trading. Each is described separately below.

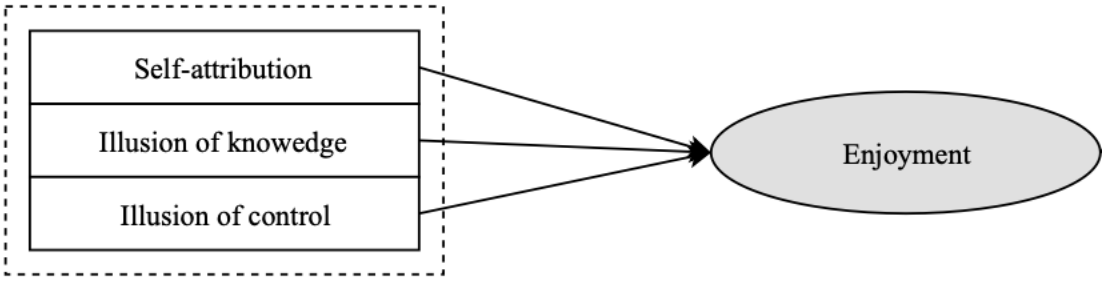

Figure 5: Enjoyment underlying drivers

Self-attribution is evident when investors attribute decisions with positive outcomes to themselves, and negative outcomes elsewhere (Konana & Balasubramanian, 2005). The applicability of self-attribution to online investing is particularly evident with investors using traditional brokers. The perceived competence and experience levels of brokers result in an assumption among investors that broker decisions are well informed (Kahneman & Riepe, 1998). Volatility in financial markets can result in undesirable broker decisions; in this case, self-attribution is evident when investors assign the responsibility of their losses to a broker (Konana & Balasubramanian, 2005). Gervais and Odean (2001) find that investors often relate their own insights to increased returns and as a result recognise failures less and overemphasise successes. Konana and Balasubramanian (2005) go on to point out that investors exaggerate the quality of their own decisions due to the vast amount of information available online. Ultimately this allows for investors to overemphasise decisions with positive outcomes and relieve decisions with negative outcomes. Their study goes on to highlight that overconfident investors, subject to self-attribution, will be satisfied with a lower return. Berger et al. (2018) describe how by imitating signal providers in copy trading, investors can delegate investment decisions to more experienced or more competent investors. Therefore, the investor's decision shifts from being between trades to between signal providers. Considering the decision made by followers between signal providers ultimately results in either positive or negative financial returns, self-attribution can be applied to the context of copy trading. Investors can associate successful investment outcomes with their own choice of signal provider and can associate unsuccessful investment outcomes with the decisions of the signal providers they follow. Overconfidence stemming from self-attribution ultimately derives greater satisfaction for investors (Konana & Balasubramanian, 2005), aligning with the framework's core construct of enjoyment.

The illusion of knowledge is referred to by Konana and Balasubramanian (2005) as an investor's excessive perception of their own competence and expertise. This stems

from the study of Barber and Odean (2001b) who suggest that online investors have access to far more information than previously, often in disintermediated environments. The proposition that the volume of information available correlates with increased knowledge and better decision-making appeals to investors. However, the relevance of the information and the ability of the investor to use the information is more important. Therefore, a greater volume and variety of information is likely to feed the illusion of knowledge and ultimately promote overconfidence (Barber & Odean, 2002). With regard to information in copy trading, Glaser and Risius (2018, p. 2) highlight the high degree of transparency for investors. When engaging in copy trading, investors have "real-time resolution control" over their invested capital and full visibility over signal provider trading decisions along with the wealth of financial information provided online outside social trading platforms. Due to this volume of information available on social trading platforms, it is reasonable to assume that online investors' illusion of knowledge does not deteriorate in the context of copy trading. Konana and Balasubramanian (2005) associate investors' satisfaction levels with the illusion of knowledge, again aligning with this framework's core construct of enjoyment.

The illusion of control is defined by Langer (1975, p. 3) as an excessively high "expectancy of personal success". Essentially, the illusion of control in copy trading is observed when an investor overestimates their ability to control an investment outcome (Konana & Balasubramanian, 2005). In the online investing domain, Barber and Odean (2002) have identified involvement as a catalyst for the illusion of control among online investors. In a survey, their study observed that one of the main reasons investors began trading online was due to a feeling of empowerment. Barber and Odean (2001b) highlight that online investors are likely to trade excessively and speculatively as a result of the illusion of control when making investments, ultimately decreasing returns. Konana and Balasubramanian (2005) describe how the illusion of control among investors results in overconfident trading, consistent with the findings of Barber and Odean (2001b). In the context of copy trading, control among followers can be transferred from choosing between trades to choosing between signal providers via copy trading. As such, control in the traditional sense of online investing remains however trades are executed by signal providers via imitation (Berger et al., 2018). Konana and Balasubramanian (2005) identify that the illusion of control among online

investors results in overconfident trading and increased self-attribution, ultimately deriving satisfaction for investors, aligning with this framework's core construct of enjoyment.

In summary, according to previous literature, self-attribution among participants in copy trading, combined with an illusion of knowledge and an illusion of control provides satisfaction for investors. This study's framework defines enjoyment as the extent to which the activity of using a new application is perceived to provide reinforcement, apart from any performance consequences that may be anticipated as per TAM. By incorporating the analysis of existing literature on online investing and copy trading, the framework suggests that self-attribution, the illusion of knowledge and illusion of control are the foundational underlying drivers of enjoyment among investors in copy trading.

5. Signal provider trustworthiness

Usefulness, ease of use and enjoyment were adapted from TAM (Davis, 1989, 1993) as the core constructs for this research's framework. These core constructs, as per TAM, are considered basic determinants of a user's acceptance or rejection of a new technology. While these constructs and their underlying drivers illustrate to a certain extent why an online investor would engage in copy trading, the framework suggests that the TAM core constructs alone aren't enough to engage online investors. Previous literature has identified that for TAM to accurately reflect a user's acceptance of certain technology, additional factors of acceptance must be considered (Pikkarainen et al., 2004). This study considers signal provider trustworthiness as a mediator for the relationship between TAM's core constructs and an online investor's intention to engage in copy trading. By adding signal provider trustworthiness as a core construct, the framework is refined specifically to the context of copy trading. Therefore, signal provider trustworthiness and its subcomponents, cognition-based signals and affect-based signals, are added to TAM's core constructs to model investors' intention to engage in copy trading. This is illustrated in figure 6 at the end of this section.

Existing literature has identified the importance of signalling trustworthiness, in a variety of contexts in online communities, to overcome the difficulties of developing trust online (O'Sullivan, 2015; Pagani, Hofacker, & Goldsmith, 2011; Shankar, Urban, & Sultan, 2002; Yousafzai, Pallister, & Foxall, 2005). While trust online has

been highlighted and researched in varying contexts, the work of Wohlgemuth et al. (2016) highlight the importance of signalling trustworthiness specifically within social trading networks. Their research describes how trustworthiness plays a particularly relevant and important role in the context of copy trading. Copy trading allows investors to directly imitate a signal provider's financial decisions and, by copying these decisions without evaluation beforehand, investors must trust these signal providers. Considering the financial responsibility of each decision within social trading networks, trust and signal provider trustworthiness plays a particularly significant role. Pan et al., (2012) also point out that the lack of offline interaction in copy trading means investors solely rely on signals sent by other participants in social trading networks; therefore, the trustworthiness of signal providers is critical.

McAllister (1995) examines interpersonal trust among managers and professionals in organisations. The study found that trust is both cognition-based and affect-based. Previous literature describes how cognition-based trust is a result of "good reasons" for trust such as reliability, dependency and competency (Lewis and Weigert (1985). Affect-based trust is described as a result of interpersonal, emotional connections (McAllister (1995). Cognition-based and affect-based trust has since been applied to the interpersonal trust of investors engaging in copy trading (Wohlgemuth et al., 2016). The complex nature of financial trading requires cognition-based signals of trustworthiness to establish trust among participants in copy trading. The integration of social networks in social trading platforms means affect-based signals are also required to establish trust between signal providers and participants. Neither cognition-based nor affect-based signals on their own are deemed enough to establish trust between signal providers and followers. Trust, therefore, is modelled in the context of copy trading as a combination of cognition-based signals and affect-based signals from the signal provider. This model is conceptualised and tested in Wohlgemuth et al. (2016)'s study of signal provider trustworthiness on the social trading network eToro.

a. Cognition-based signals of trustworthiness

Cognition-based signals of trustworthiness indicate the technical competence of a trusted individual in a specific field or for a specific task. In the context of copy trading, the domain-specific task and indicator of technical competence are referred to

as the identification and execution of profitable investment decisions (Doering et al., 2015).

In Wohlgemuth et al. (2016)'s study, four cognition-based signals of trustworthiness were identified. The first signal was "profitable trades", referring to the number of trades with positive outcomes. The second cognition-based signal of trustworthiness was "return", referring to the annual return on investment. The third cognition-based signal of trustworthiness was "maximum drawdown", referring to an investor's greatest loss over the course of one week as a percentage of the account's balance. The fourth cognition-based signal of trustworthiness was "risk level", referring to the risk appetite of the signal provider in question. These four cognition-based signals of trustworthiness provide a detailed picture of the signal provider's trustworthiness.

b. Affect-based signals of trustworthiness

Affect-based signals of trustworthiness indicate that a trusted individual shares similar values with the trustor (McAllister, 1995). The social component of affect-based signalling complements the technical cognition-based signals of trust. A differentiating factor between cognition-based and affect-based signals of trustworthiness is the ability to transfer affect-based signals between tasks. As a result, affect-based signals of trustworthiness generate interpersonal trust as a result of demonstrating social competence (Pan et al., 2012). Examples of these include full name, personal pictures, number of followers, and previous performance.

In Wohlgemuth et al. (2016)'s study, two affect-based signals of trustworthiness were identified. Building on the study of McAllister (1995, p. 30), the first two affect-based signals were derived from "citizenship behaviour"; in the context of social trading. This refers to the behaviour of participants with the intention of "effective community functioning not directly resulting from self-interest or reward-seeking behaviour" (Wohlgemuth et al., 2016, p. 3). In the study, the disclosure of both a personal picture and full name, in addition to a username, were affect-based signals of trustworthiness and enough to portray a signal provider's identity to followers. This aligns with the findings of Mesch (2012), who associate the disclosure of personally identifiable information with online trust. The second indicator of affect-based signals of trustworthiness was interaction frequency (Wohlgemuth et al. (2016). In the context of copy trading, interaction frequency referred to the trading frequency of members in

the online community. This signal was quantified by identifying a trader's number of active days on the investment platform.

The results of Wohlgemuth et al. (2016) highlight the complementary nature of cognition-based signals and affect-based signals in establishing trust and prompting decisions among followers in the context of copy trading. Specifically, in terms of signalling, the results of their study illustrate that "profitable trades", "return" and "maximum drawdown" are cognition-based signals. In conjunction with these is the presence of a picture, full name and interaction frequency, which are affect-based signals enabling followers to establish trust in signal providers.

In summary, financial performance matters when establishing trust among followers, however signal providers must also demonstrate each appropriate affect-based signal. Followers do not rely on the cognition-based signal, "risk level", to establish trust. Wohlgemuth et al. (2016) refer to the risk-return trade-off associated with trading and corresponding follower preferences as a plausible explanation for this finding. Their findings also highlight the importance of trustors preferences in establishing trust.

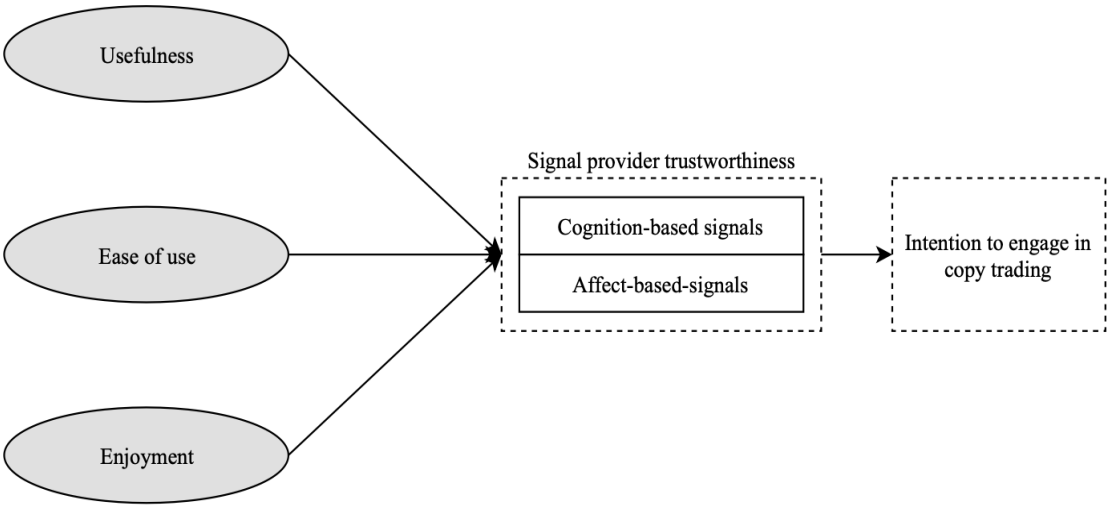

Figure 6: Signal provider trustworthiness as a mediator.

6. Investor Engagement Framework discussion

This study's framework intends to model online investors' intention to engage in copy trading; this is illustrated in full in figure 7. Three of the framework's core constructs are derived from TAM: usefulness; ease of use; and enjoyment. These core constructs are used as a basis to examine investor intentions to engage in copy trading. To contextualise the constructs, features of copy trading are identified as underlying

drivers of each core construct. Firstly, the framework identifies that imitation, risk management and return on investment are deemed to enhance investor performance, therefore, increase the perceived usefulness of copy trading. This suggests that for investors to engage in copy trading, it must be emphasised and clear that financial performance will be increased. Secondly, the framework highlights that transparency, experience level, reduced overtrading and reduced fees drive perceived ease of use. This suggests that copy trading appeals more to investors when it is perceived to be free of effort. Thirdly, the framework suggests that self-attribution, the illusion of knowledge and illusion of control make copy trading more enjoyable for investors regardless of the investment outcome.

Finally, the framework includes signal provider trustworthiness as an additional core construct which mediates the relationship between TAM's core constructs and an investor's intention to engage in copy trading. The inclusion of signal provider trustworthiness builds on TAM's core constructs in the specific context of copy trading. This trustworthiness is broken down into two separate forms of signalling, cognition based-signalling and affect-based signalling. The framework suggests that when delivered effectively, cognition-based signals and affect-based signals of trustworthiness form the trust necessary for investors to engage in copy trading.

While usefulness, ease of use, enjoyment and signal provider trustworthiness are highlighted individually as core constructs of investor engagement in copy trading, the framework's overall contribution is that the core constructs and their underlying drivers must work interdependently. It is considered that an investor's intention to engage in copy trading is nullified when any of the core constructs or their underlying drivers are absent.

7. Implications for practitioners and researchers

The framework proposed in this study ultimately details the copy trading features that specifically attract investors and build trust. These details primarily benefit practitioners. Understanding what impacts trust among investors in copy trading is important in the development of strategic and technological advancements to increase investor satisfaction and outcomes. The framework suggests that platform providers and marketers should identify and emphasise the features that users find easy to use, benefit from, and enjoy: for example, increased returns as a result of copy trading.

Finally, the framework shows that platform and signal providers must emphasise the availability of signal providers' personal information and performance information to build trust with investors.

A further benefit of this chapter's framework is in helping researchers understand the drivers of online investors to engage in copy trading and delegate their investment decisions to others online. The framework is based upon TAM's core constructs. However, this chapter extends TAM with the introduction of signal provider trustworthiness as an exogenous factor and by identifying drivers of the core constructs. Signal provider trustworthiness mediates the relationship between investors' decisions to engage in copy trading and TAM's core constructs of user acceptance. Therefore, the framework emphasises the importance of building trust between participants in copy trading. While the framework discusses each of the core constructs and their corresponding underlying drivers, it does not rank or weigh the constructs and drivers in terms of relevance or importance. To further understand what drives user acceptance of copy trading, future research could explore which specific features of this framework have the most significant effect on user intentions to engage in copy trading and intentions to delegate investment decisions to others. While objectives generally vary from investor to investor, an attempt could be made to filter out less significant factors in engaging in copy trading to further refine the framework presented in this study.

8. Conclusion

Existing research on copy trading identifies individual features that drive its growing popularity. This chapter proposes a conceptual framework to accurately synthesize and extend this existing literature. Firstly, the chapter identifies that TAM's core constructs must be extended when applied to the context of copy trading engagement. Trust is considered paramount in investment decisions, particularly when the decision is influenced by others. As a result of this, signal provider trustworthiness is identified as an appropriate core construct to extend TAM. In total, perceived usefulness, perceived ease of use, enjoyment and signal provider trustworthiness make up the framework's core constructs. Finally, the overall contribution of the framework proposed in this study is that the combination of perceived usefulness, ease of use, enjoyment and signal provider trustworthiness drive investor engagement in copy trading.

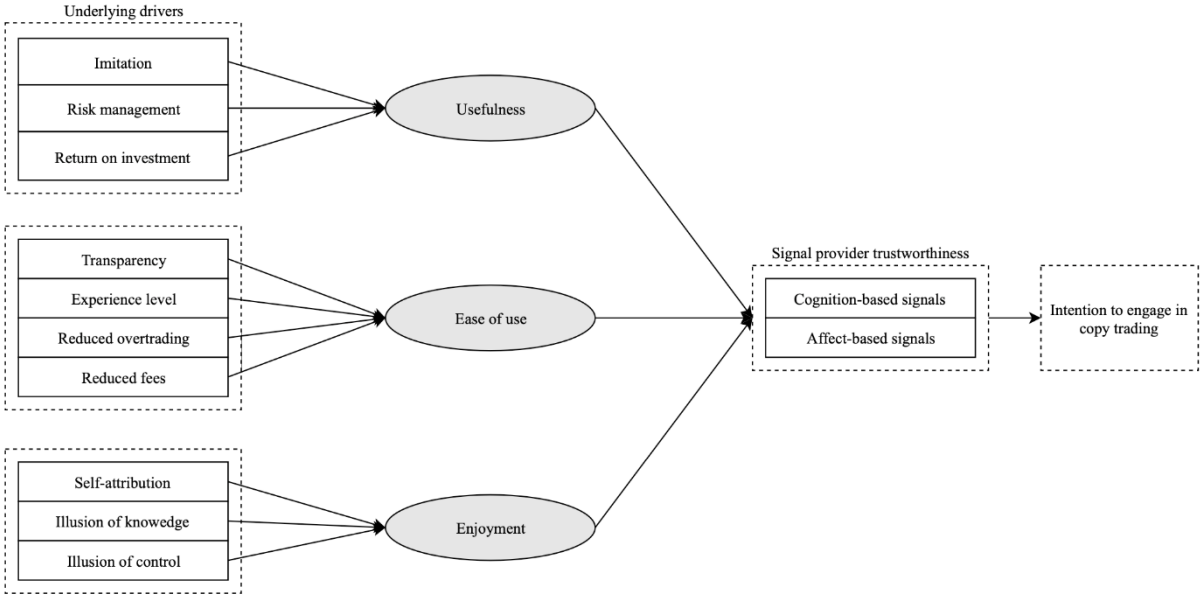

Figure 7: Full IEF modelling investors' intention to engage in copy trading.

Chapter 3: Investor decision making: an investigation of the modality effect.

Abstract:

This study hypothesizes that the modality effect can enhance an investor's ability to learn from investment-related information and ultimately better inform their investment decision. To test this, two separate systems were designed using a Repertory Grid analysis conducted with key informants to elicit features and functionalities. Each system provided the same information about a fictional stock to two separate groups of retail investors. One system provided solely visual information and the other provided a combination of audible and visual information. Each groups' ability to retain and transfer information was then examined. This was done by testing for the modality effect which states that learning is enhanced when processing concurrent audible and visual information. The results showed a reverse modality effect, suggesting there is no benefit to investors by replacing text with audio when accompanying related visual information. However, investors using the system with combined audible and visual information took a shorter amount of time on average, to process this information than the investors using the solely visual system. These findings suggest that combined audible and visual information does not enhance an investor's ability to learn from investment-related information and ultimately, that investor decisions are better informed by solely visual information. However, a higher level of confidence is plausibly demonstrated by participants' shorter processing time of combined audible and visual information. Therefore, while combining audio with visual information does not increase understanding of financial material presented, it does increase the speed at which that information is processed.

1. Introduction

This chapter investigates the second research question of through what information these investors are using to invest online. This chapter examines the modality effect. In Gibson (1992, p. 2)'s study of financial information for decision making, a model is derived in which individuals consider the "utility of outcomes" before making the decision. This model is built on the core assumption that complete information is available to the decision-maker. Therefore, in the absence of complete and perfect information, the decision made may not result in the optimum outcome. The question remains as to how to ensure that the required information is available to those making financial decisions.

Information modality refers to the use of different "sensory channel used to process information" (Moreno, 2006, p. 1); an example of this is the processing of audible or visual information. Instances of audible information are voice assistants such as Apple's Siri, Microsoft's Cortana and Amazon's Alexa (Hoy, 2018) utilising advancements in natural language processing (Hirschberg & Manning, 2015) and Voice-based User Interfaces (Ghosh, Foong, Zhang, & Zhao, 2018). While advances in this technology are evident, existing literature that compares voice and text in questioning answering (QA) systems has shown mixed results. While research has been conducted comparing singular modes of information communication, Sharma, Pavlović, and Huang (2002) suggest that multimodal human-computer interaction can improve the flow of information between the user and computer systems. In the context of this study, multimodal human-computer interaction refers to human-computer interaction both audibly and *visually*.

Amazon's Echo Show uses two separate modes of information communication: visual when information is displayed on the Echo Show screen and audible when interacting verbally with Alexa - Amazon's voice-based personal assistant. Previous research has identified the modality effect, which describes how learning is enhanced when text is replaced by audible information accompanying a related piece of visual information (Ginns, 2005). To date, the modality effect has not been considered in the area of investors making investment decisions. This study hypothesizes that the modality effect can enhance an investor's ability to learn from investment-related information

and ultimately better inform their investment decision. This will be tested by using the Amazon Echo Show which can display investment-related information both visually onscreen and audibly using Alexa. By using the Amazon Echo Show, the study applies the findings of previous modality effect literature to the specific context of retail investor decision making. During this study, retail investors are defined as "individuals who own stock by any means" (O'Hare, 2007, p. 3).

The study begins by describing information modality through an examination of existing literature. The following section identifies features of electronic systems that are used in previous literature to test for the modality effect. From there a Repertory Grid analysis is performed with key informants to derive features and functionality for this study's Amazon Echo Show system. Following this, the testing procedure is described in which the Amazon Echo Show is used with another group of key informants to test investor decision-making through the lens of the modality effect. The next section outlines the results and analysis of the tests performed. Following this, the implications of these results from testing are discussed. Finally, the study concludes with practical implications and avenues for future research.

2. Information Modality

Baddeley (1992, p. 1) developed a working memory model consisting of several interrelated subsystems. Two of these subsystems process visual and audible information separately: these are the "visuo-spatial scratch pad" and "articulatory loop respectively". The visuo-spatial scratch pad processes visual information and has recently also been referred to as the visual-spatial sketchpad (Leahy & Sweller, 2011, p. 2). The articulatory loop is divided into two subcomponents: the phonological input store and the articulatory rehearsal process which both process audible information.

Van Merrienboer and Ayres (2005, p. 1) describe "extraneous cognitive load" as excessive amounts of information being processed by certain components of working memory such as the articulatory loop or visual-spatial sketchpad. An example of this is the work of Leahy and Sweller (2011), where a group of subjects process visual-only information, in the form of a diagram and on-screen text, less effectively than when the same diagram is displayed with the text replaced by audible information. This demonstrates that when working memory is split between visual and auditory

processors, the ability to deal with information may be increased by using both processors concurrently rather than just one.

This demonstration of increased capacity in working memory is referred to as the modality effect. The modality effect is evident when audible information displayed concurrently with related visual information enhances learning more effectively than visual information on its own. The audio/visual information presented must be directly related; if the information only complements other information in a different modality, the modality effect will not be obtained (Low & Sweller, 2005). The modality effect is also referred to as the "separate stream hypothesis" (Penney, 1989, p. 1) or "split attention effect" (Mousavi, Low, & Sweller, 1995, p. 1). A reverse modality effect is obtained when visual information on its own enhances learning more effectively than audible information displayed concurrently with related, visual information (Inan et al., 2015; Leahy & Sweller, 2011). To test for the modality effect among retail investors, we examine existing literature to determine which system features are likely or unlikely to result in a modality effect with financial decision making.

3. System features in modality effect literature

To determine what features are required in an audio/visual system to optimise financial decision making, a systematic review (Webster & Watson, 2002) of existing literature on the modality effect was carried out. The search was conducted in a similar fashion to the method from the previous chapter. Keywords that were inputted were 'financial decision making', 'online investing', 'voice-based user interface', 'natural language processing', 'information modality' and 'modality effect'. Leading research journals were then examined. The journals examined included *Learning and Instruction, British Journal of Educational Technology, Journal of Computer Assisted Learning, Journal of Experimental Psychology, and Educational Technology Research and Development.* Citations of identified articles were used as further research sources.

During the systematic literature review, recurring core features of audio/visual systems are identified that can result in a modality effect with participants. This study considers that investor decisions will be enhanced as a result of the modality effect. In order to examine this, the core features that result in a modality effect are incorporated

in the design of a system to test for the modality effect among investors. These features are described in detail below (with the core concepts identified by italics).

In the literature, there is an emphasis on the importance of information length when testing for the modality effect. While displaying an instructional diagram in experiments, Mayer and Moreno (1998) obtained a modality effect when related audible narration accompanied the diagram. Results of this study revealed that concise and highly concentrated audible narration of visual diagrams allowed participants to process the information most effectively when in parallel in working memory. This study, and others such as Inan et al. (2015), prove that for the modality effect to be present, *audible information must be short and concise*.

Leahy and Sweller (2011) observed that long and complex information transmitted audibly and visually resulted in a reverse modality effect. Their study revealed that detailed, longer pieces of information may excessively load working memory when presented in audible form rather than written form. Inan et al. (2015) reiterate this by observing that learning improved when long, spoken text was replaced by written text when presenting unfamiliar information to participants. This suggests that *long and detailed information should be communicated in a solely visual way*; however, *the modality effect was evident with shorter pieces of information* when transmitted both audibly and visually.

The timing of audible information impacts the performance of participants according to previous literature (Mayer & Anderson, 1992). For example, Mayer (1997)'s study identifies that subjects perform better when visual information is processed with concurrent rather than sequential narration. Moreno and Mayer (1999) tested the modality effect by providing participants in their study with a visual describing the formation of lightning narrated with audible information both before and after the visual in different tests. Findings revealed the modality effect was present as participants' connections between corresponding visual and verbal information more effectively. This suggests *audible information displayed concurrently with visual information assists with the modality effect*. In another study, Moreno and Mayer (1999) provided audible narration and text either concurrently or sequentially in different tests with participants. Findings revealed an advantage of audible narration over text; however, *this advantage did not disappear when presentations were made*

sequential contrasting previous findings suggesting the superiority of concurrent audible information.

Moreno and Mayer (1999)'s study tests the idea that the modality effect is achieved more effectively when visual information is close in proximity (Mayer & Anderson, 1992). This was done by presenting concurrent visual text and related animations to participants. The text was displayed at the bottom of the screen for one test and next to the corresponding part of the diagram for the other. Results showed that the interpretation of information is impaired when on-screen text is spatially separated from the visual materials. This is consistent with results from Inan et al. (2015)'s study that suggests information that isn't displayed in close proximity can plausibly result in a reverse modality effect. In summary, to effectively display and communicate information in an audio/visual way, the *information should be condensed into a smaller visual field*.

Rummer, Schweppe, Fürstenberg, Seufert, and Brünken (2010) investigate the modality effect by testing each subject's ability to recall sentences and unrelated visual diagrams (matrices), one simple, one more complex. The study examines the impact of eye-movement on the participants' ability to recall sentences by displaying the sentence for one group word-by-word in the centre of the screen, followed by the matrices. Results suggest participants listening to sentences or reading with less eye-movement outperformed those in the standard reading group regarding matrix recognition. This demonstrated that eye-movements during reading hamper participant's ability to process information and reiterate the previous findings that *visual information should be condensed* (Moreno & Mayer, 1999).

Tabbers, Martens, and Van Merrienboer (2001) investigate the modality effect with an interactive system where either the user or the system controls the pace of the information displayed depending on the experiment. In one experiment, participants used a system with a predetermined pace for displaying information, *results suggested the superiority of audio over visual text as narration*, essentially yielding a modality effect. In a second experiment, where users had control over the pacing of the instructions, retention of information by participants with visual information outperformed those with audible information, yielding no modality effect. This result is replicated more recently by Tabbers, Martens, and Van Merriënboer (2004) and

Inan et al. (2015), suggesting that *when participants have more time or control the pace of the information displayed, a reverse modality effect can be demonstrated.*

Tabbers et al. (2004) investigate the impact of visual cues on the modality effect; in this case visual cues refer to certain pieces of visual information. They are utilised to reduce visual search in multimedia presentations, thus increasing effectiveness. The testing involved a non-technical diagram accompanied by either visual text or audible instructions. To reduce visual search, visual cues in the form of bright red colours referring to specific parts of the diagram were applied. Results highlighted that *visual cues were only effective in terms of retaining the information* portrayed by the diagram, however *no difference in terms of mental effort spent or ability to transfer information* was noticed, yielding an overall reverse modality effect.

In summary, the system features and functionalities identified during this review have been tested in previous literature on the modality effect. This analysis of existing research has determined which features are essential to building an effective audio/visual system. This study investigates the modality effect specifically in the context of retail investing, therefore system features identified as relevant to the modality effect will be presented to a group of retail investors during interviews. The results of these interviews with key informants will inform the functionality of an audio/visual system that presents investment information to retail investors. Table 3 illustrates which system features yield either a modality effect or a reverse modality effect according to the literature described above. These system features are used as elements in a RepGrid analysis (Bernard & Flitman, 2002) with investors, from which system functionality is derived during interviews. This is described in detail in the next section below.

System Features	Modality Effect	Reverse Modality Effect
Short, concise information	✓	
Long, detailed information		✓
Concurrent audio/visual information	✓	
Sequential audio/visual information	✓	

Visually condensed information	✓	
System-paced information	✓	
User-paced information		✓
Visual cues		✓

Table 3: Potential system features found in previous literature and corresponding modality effect outcomes.

4. RepGrid Analysis

To test for the impact of audio/visual information on retail investor decision making, a visual and audio/visual system was required for comparative testing. These systems were built using an Amazon Echo Show which displayed information about a fictional stock onscreen for visual-only testing. For audio/visual testing, audible information was presented using Amazon's voice assistant Alexa, and visual information was presented onscreen. The RepGrid analysis was used as an interviewing technique with the targeted user group, retail investors, to elicit how information should best be presented by the system.

Kelly (1977) derived the RepGrid analysis from his personal construct theory which improves the interpretability of an interview participant's views and opinions. Further literature describes how RepGrid interviews reduce bias and allow for participants to interpret certain topics in a less restricted way (Hunter, 1997). In the context of information systems, the RepGrid analysis has been validated as a useful method for the cognitive analysis of users (Tan & Hunter, 2002). The RepGrid analysis has also been described as a useful qualitative interviewing technique to gather unbiased information systems data (Hunter, 1997).

There are four components to the RepGrid analysis: the topic, the elements, the constructs, and ratings (Easterby-Smith, 1980). The topic of this analysis is the impact of audio/visual information on investor decision making. Elements are considered to be instances of the topic: in this case, ways of communicating audio/visual information to investors. The elements were derived from the systematic literature review and are outlined in figure 1.0. Constructs are considered to be opposing opinions of elements

(Coshall, 2000; George A Kelly, 1977). Constructs are derived during the construct elicitation stage of the interview in which a triadic comparison is used (Kelly, 1955; Kelly, 1970). A triadic comparison occurs when the interviewer presents the participant with three elements from the RepGrid and asks the participant to identify a "way in which two of the elements are similar yet different from the third". Bernard and Flitman (2002, p. 3) states the way in which two of the three elements are similar in a positive way forms the likeness pole and the way in which the third element differs negatively forms the contrast pole. In order to understand the context and meaning of a particular construct, Hinkle (1965) conceived laddering as a technique to further explore relationships between constructs by identifying and developing a hierarchy. In this study, laddering up was used to reveal superior constructs within the hierarchy (Stewart, Stewart, & Fonda, 1981). In interviews, participants are asked "Which pole do you prefer and why?" to ladder up (Bernard & Flitman, 2002). Ratings are then used to link constructs and elements (Hunter, 1997). A Likert scale with five intervals is used to allow participants rate the elements based on the constructs, with one being the likeness pole on the left and five being the contrast pole on the right (Fransella, Bell, & Bannister, 2004). Typically the lower numbers relate to the more positive pole (Harter, Erbes, & Hart, 2004).

4.1. RepGrid Interviewing Procedure

The RepGrid analysis interviews were conducted over three weeks in March 2019. These interviews were conducted with a group of four key informants (McAvoy, 2006). Each participant was selected from a group of investors running and managing a retail investment fund. This investment group was introduced through a fellow researcher in Business Information Systems (BIS). Each key informant had experience with investment and used social media as part of their decision-making process. Key informants are not intended to represent a certain population statistically (George and Reve, 1982). Instead, they have a higher level of knowledge in the field being researched and are willing to communicate this knowledge (Campbell, 1955). Babbie (1998) describes how key informants are particularly effective when research targets theoretical concepts that aren't well understood. This study considers that retail investors can enhance their ability to learn from investment-related information via the modality effect, resulting in better-informed decisions. While investor decision

making has been thoroughly researched, the application of the modality effect to the context of investor decision making has not been researched previously, therefore, it is not well understood. With this in mind, key informants are deemed appropriate to interview. As per Campbell (1955)'s description, key informants are selected from a group of investors running and managing a retail investment fund and who are willing to share their experiences with systems they've used to receive investment information.

Once the key informants were selected. The interviews were conducted individually. These interviews were conducted face-to-face. Initially, the context of the research was explained to participants. The description of this context involved explaining how the research was focused on the presentation of information to retail investors during a comparative analysis of a fictional stock. It was then explained that the purpose of the interviews was to identify the format in which retail investors preferred to receive information.

The RepGrid was presented to participants populated with just the elements as shown in Figure 8 The elements were described to participants as being derived from existing literature and are ways of presenting audio/visual information. Participants completed a triadic comparison in which the interviewer presented three separate cards, each with one element from the RepGrid. The interviewer then asked: "In what way are two of these three elements similar to each other and different from the third?" The corresponding answers were written by the interviewer in the RepGrid forming constructs. An example of this from interviewing was the triadic comparison of the elements: long and complex information, visually condensed information, and visual cues. Each element refers to how information is presented to the retail investor. One participant described how visually condensed information and visual cues are similar in that they are visual and that long and complex information differs in that longer, complex information is more often text-based and non-visual. Therefore, the construct <visual – non-visual> was formed as shown in figure 1.0. The triadic comparison process was repeated with different combinations of elements until similar constructs started emerging. Laddering was then used as a technique to identify hierarchical relationships amongst the constructs. Participants were asked: "Which pole do you prefer and why?". Figure 8 illustrates that the participant preferred "Visual" as it

allows information to be more easily interpreted, this resulted in the superordinate construct <easily interpreted – hard to interpret>. Following laddering, the respondent was asked to rate all information regarding each construct, using the Likert scale discussed above with one referring to the likeness pole and five referring to the contrast pole.

	Elements								
Likeness Pole	Long & Complex Information	Short & Concise Information	Visually Condensed Information	Concurrent Display	Successive Display	User-paced Interaction	System-paced Interaction	Visual Cues	Contrast Pole
Easily Interpreted	3	2	2	1	3	1	4	1	Hard to interpret
Visual	4	1	1	2	2	3	3	1	Non-visual
Total	7	3	3	3	5	4	7	2	

Figure 8: Sample RepGrid from interviews

4.2. RepGrid Interview Results and Elicitation of System Features

To derive system features and functionality for the financial decision-making system, RepGrid interview results were analysed based on participant ratings of elements. For each element, ratings were summed and noted at the bottom of the column as can be seen in figure 8. Five triadic comparisons of elements resulted in five constructs describing elements positively in the likeness pole and negatively in the contrast pole according to participants. Laddering up followed the triadic comparisons to derive superordinate constructs, which explained why certain elements are positive in the likeness pole or negative in the contrast pole. While rating each element, one referred to the likeness pole and five referred to the contrast pole as described above, therefore lower total ratings indicated a participant's preference for a certain element. The ratings were totalled for each element, total ratings from each interview were then added together to provide an overall rating for each element. The overall total was then used to quantify priority amongst elements with the lowest total being of the highest priority and the highest total being of the lowest priority as system features. Figure 9 shows the total for each element per interview, an overall total rating and a priority ranking.

	Long & Complex Information	Short & Concise Information	Visually Condensed Information	Concurrent Display	Sucessive Display	User - Paced Interaction	System-Paced Interaction	Visual Cues
Participant 1	40	29	21	27	31	30	32	25
Participant 2	26	27	31	28	31	28	26	25
Participant 3	21	24	20	19	22	18	29	21
Participant 4	28	33	25	35	32	30	33	34
Total Rating	115	113	97	109	116	106	120	105
Priority Ranking	6	5	1	4	7	3	8	2

Figure 9: RepGrid results including the total rating for each element per interview, an overall total rating, and a priority ranking.

Based on the requirements identified and prioritised in the RepGrid interviews, two proof of concept (POC) systems were developed which displayed information about a fictional stock to a group of retail investors. Elicitation of system features was based on priority rankings of elements as shown in figure 9. System features were prioritised as follows; visually condensed information, visual cues, user-paced interaction, concurrent display, short and concise information, long and complex information, successive display and system-paced interaction. One POC was created that presented information onscreen in a solely visual way, the second POC was created to present information in an audio/visual way - visually onscreen and audibly through the Amazon Echo Show's voice assistant, Alexa. Both systems were tested with separate groups of key informants to investigate the modality effect and its impact on retail investor information.

5. Testing Procedure

The participants chosen for testing were a different group of key informants from the group of investors who took part in the RepGrid analysis. Considering the purpose of the RepGrid analysis was to derive suitable system features for testing both visual and audio/visual systems, different key informants were chosen for testing to remove any potential bias. During testing, participants received information about a fictional stock (STK). The stock was fictional to allow participants to focus solely on the information presented during testing. One group of participants viewed the information onscreen in a solely visual way (Visual Test Group), with no audible information available, and no ability to interact with Alexa once the information was displayed. Another group of participants viewed the information onscreen with audible interaction

(Audio/Visual Test Group). Audible information was available upon request by speaking to Alexa. Participants were allocated to either the Visual Test Group or the Audio/Visual Test Group at random, each group consisted of seven participants. To reveal a modality or reverse-modality effect in participants, the following tests were used for both groups: Retention, Transfer, and Satisfaction. These tests are explained in this section. The test questionnaires are available in Appendix 1. All tests contained closed questions such as correct/incorrect answers and ratings from 1-5.

5.1. Visual Test Group Testing Procedure

Figure 9 displays the information provided to participants in the Visual Test Group. The price change of this stock included visual cues to allow participants to interpret the price-performance more easily as suggested by the RepGrid analysis. Font colour was used as a visual cue with any negative change in price percentage represented by red font, and any positive change in price percentage represented by green font.

A chart displaying price movement of the stock over one day was located close in proximity to the price percentage changes to align with the results of the RepGrid analysis suggesting information should be condensed visually.

Revenue and market capitalisation information was displayed on the right-hand side of the chart. Bold text was used as a visual cue to emphasise the figures for revenue and market capitalisation. Information regarding peer performance and historical comparison of revenue and market capitalisation was displayed with short and concise pieces of information, condensed visually using bullet points and narrow margins. The inclusion of visual cues, visually condensed, and short and concise information was again, in line with findings of the RepGrid analysis.

News headlines were displayed in proximity beneath the chart. These headlines were also short and concise with italic font used as a visual cue to allow participants to make a distinction between headlines and other information.

Participants began processing the information onscreen. Participants could finish processing the information whenever they felt ready to move onto the next section of

testing. This aligns with results of the RepGrid analysis that suggest a priority should be placed on user-paced system interaction.

Figure 10: Information presented to Visual Test Group during testing.

5.2. Visual Test Group Testing Procedure

Figure 9 displays the information provided to participants in the Audio/Visual Test Group. Like the previous visual group testing procedure, visual cues and visually condensed information were prioritised in order to apply the findings of the RepGrid analysis to the Audio/Visual testing procedure. Green and red font colours were used as a visual cue to inform the participant about positive and negative price changes respectively. Bold text was used as a visual cue to emphasise the figures for revenue and market capitalisation. For the condensed visual information, again, the stock's price chart was located close in proximity to the changes in price percentage.

While the audio/visual test group used similar features to the visual test group such as visual cues and visually condensed information, participants in the audio/visual test group interacted with the system using their voice, i.e. audibly. To view the information in figure 11 and initiate testing participants stated: "Alexa, ask State Street app to show the stock." Alexa then audibly stated the information displayed onscreen. Additional information for peer performance, historical comparisons and news was available to participants with further questioning described below. Additional information delivered audibly was the same as the information provided visually for the Visual Test Group.

For a participant to request revenue information they would state: “Alexa, tell me about the revenue”. Alexa would then respond audibly: “This was the highest revenue of all technology companies in the S&P 500. S&P 500 technology companies average revenue growth over the last 5 years is 1.8%. Revenue is down 1% on last year. Revenue is up 2% on average in the last 5 years.”

For a participant to request market capitalisation information they would state: “Alexa, tell me about the market cap”. Alexa would then respond audibly: “This is the third-largest technology company by market cap. The market cap is up 1% on last year. Market cap is up 5% on average over the last 5 years.”

For a participant to request information from the news they would state; “Alexa, tell me about the news”. Alexa would then respond audibly: “Report shows STK streaming service has lost subscribers in the last 6 months. STK earnings report indicates growth and success of recent products. Ground-breaking STK payments product doubles its market share in the last year.”

Participants began processing information both onscreen and audibly. Participants could finish processing this information whenever they felt ready to move onto the next section of testing. Again, this aligns with results of the RepGrid analysis that suggest a priority should be placed on user-paced system interaction and to ensure consistency with the test for the visual test group. All information provided audibly was short and concise, consistent with RepGrid findings. Participants could ask Alexa for additional, audible information as many times as they deemed necessary.

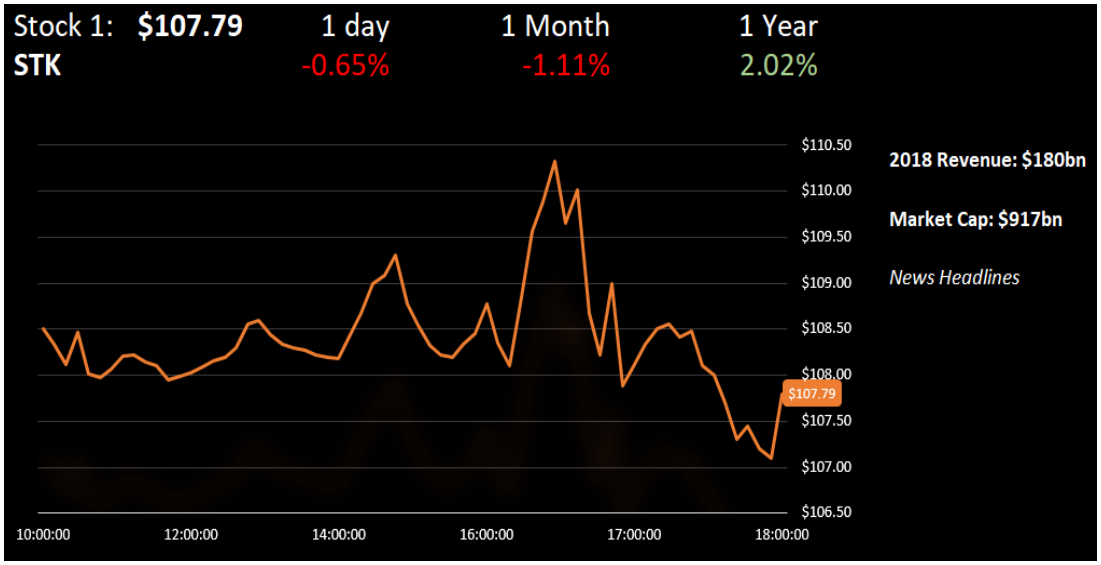

Figure 11: Information presented to the Audio/Visual Test Group during testing, additional audible information was available when requested from Alexa.

5.3. Retention Test

To reveal a modality or reverse modality effect, each participant's ability to retain information from testing was assessed. Six questions were asked regarding the information presented during both visual and audio/visual tests, and the answers were scored for accuracy. Figure 5 presents each question asked during the retention test, possible correct answers and the corresponding points awarded. For example, for question 1, "What is the stock price?", participants received two points for writing "$107.79". Any other answer received no points. Each participant's points were added for the six questions and then divided by a total possible 44 points. This figure was then multiplied by 100 and rounded to the nearest whole number to result in a percentage representing the participant's overall retention score.

Question		**Answers**	**Points**
1	What is the stock price?	$107.79	2
2	What is the 1 day, 1 month & 1 year stock price percentage change?	1 day: -0.65% 1 month: -1.11% 1 year: 2.02%	2 2 2
3	What is the market cap? Describe its ranking amongst peers and percentage change over 1 and 5 years.	$917bn total market cap 3rd amongst peers 1% change over 1 year 5% change over 5 years	2 2 2 2
4	What was the 2018 revenue? Describe its ranking amongst peers and percentage change over 1 and 5 years.	$810bn in revenue in 2018 1st amongst peers 1% change over 1 year 2% on average over 5 years	2 2 2 2

5	What is the average percentage change in revenue of technology companies in the S&P 500 over the last 5 years?	1.8%	2
6	Describe the news headlines.	Streaming Lost subscribers Growth in earnings Successful products Payments product Doubled market share	2 4 4 2 2 4
			44

Table 4: Questions, answers and corresponding points awarded during the retention test.

5.4. Transfer Test

To reveal whether a modality effect was present or not, a transfer test was carried out. This involved assessing each participant's ability to apply information received during testing to solve problems. Three questions were asked regarding the information presented during both visual and audio/visual presentations. Table 5 presents each question asked during the transfer test, possible correct answers and the corresponding points awarded. Each participant's points were added for the three questions and then divided by a total possible 30 points. This figure was then multiplied by 100 and rounded to the nearest whole number to result in a percentage representing the participant's overall transfer score.

Question		**Answers**	**Points**
1	How would you describe the stock price performance over the short and long term?	<u>Short term:</u> Any negative wording 1 day/short term	 2 2

		Long term: Any positive wording 1 month/1 year/long term	 2 2
2	How would you describe the stock's performance against its peers?	Regarding revenue: Any positive wording Revenue Regarding market cap: Any positive wording Market cap	 2 2 2 2
3	How do you interpret the news headlines in relation to this stock?	Regarding overall sentiment: Any positive wording Regarding the first headline: Any negative wording Streaming Regarding the second headline: Any positive wording Earnings Regarding the third headline: Any positive wording Payment products	 2 2 2 2 2 2 2
			30

Table 5: Questions, answers and corresponding points awarded during the transfer test.

6. Testing Results

According to modality effect literature, audible information displayed concurrently with related, visual information enhances learning more effectively than visual information on its own. A reverse modality effect is obtained when only visual information enhances learning more effectively than audible information displayed concurrently with related, visual information. Following testing with both the Visual Test Group and the Audio/Visual Test Group, results were noted from transfer and retention tests. The results were then compared to identify any disparity between each testing group's performance during the experiment. Retention of information and transfer of information were tested in order to identify whether the modality effect was present or not, and to investigate how effectively each group processed the information presented.

Table 6 illustrates how the Visual Test Group outperformed the Audio/Visual Test Group on average regarding retention of information (Audio/Visual Test Group 23% vs. Visual Test Group 39%). Previous modality effect findings suggest that participants should retain more information during testing when verbal information related to onscreen visuals is presented audibly instead of visually. This finding suggests a reverse modality effect in the case of information retention. Considering the Audio/Visual Test Group, who received verbal information related to onscreen visuals during testing, were outperformed by the Visual Test group who received only onscreen information, a reverse modality effect is evident. This result is the opposite of what was expected with the modality effect.

Table 6 further illustrates how the Visual Test Group outperformed the Audio/Visual Test Group on average regarding transferring information (Audio/Visual Test Group 30% vs. Visual Test Group 46%). Previous modality effect findings suggest that participants should transfer information to provide problem-solving solutions during testing when verbal information related to onscreen visuals is presented audibly instead of visually. Again, the Audio/Visual Test Group, who received verbal information related to onscreen visuals during testing, were outperformed by the

Visual Test group who received only onscreen information. As a result, these findings also reveal a reverse modality effect; this is inconsistent with the predictions of the modality effect.

While retention and transfer of information amongst both groups yielded a reverse modality effect, the time spent processing information and answering questions during testing revealed an interesting disparity between the groups. On average, the Audio/Visual Test Group took 24 seconds less to process information, 22 seconds less to answer retention questions and 2 minutes less to answer transfer questions, than the Visual Test Group. Considering the Audio/Visual Test Group were outperformed by the Visual Test Group in retention and transfer of information, it is plausible that the lower average time spent answering the corresponding questions is a result of less detailed answers. However, the Audio/Visual Test Group's lower average time spent processing information provides potentially interesting implications. Participants from both test groups could finish processing the information provided whenever they felt ready to move onto the next section of testing. Participants' from the Audio/Visual Test Group felt adequately prepared to answer questions based on the information displayed in less time than participants from the Visual Test Group. This suggests that combined audible and visual information results in quicker response times than solely visual information. However, lower retention and transfer scores suggest that while Audio/Visual Test Group are quicker to respond when processing audible and visual information, they are less accurate when transferring and retaining this information. Given this information is intended to be retained and transferred to inform an investment decision, this trade-off of accuracy for speed can result in erroneous investment decisions and subsequent financial loss.

Averages	**Audio/Visual Test Group**	**Visual Test Group**
Time processing information before questioning	00:02:51	00:03:15
Retention score	23%	39%
Time answering retention questions	00:02:59	00:03:21
Transfer score	30%	46%
Time answering transfer questions	00:01:38	00:03:08

Table 6: Results for the Audio/Visual Test Group and the Visual Test Group following testing of retention and transfer of information with audio/visual and visual systems respectively.

7. Discussion

The chapter contributes several findings to the evaluation of information modality in the context of retail investors. Through a RepGrid analysis with key informant interviews, preferable system features and requirements were gathered to build a POC for testing. The findings of the RepGrid analysis suggested retail investors prioritise visually condensed information, the use of visual cues, user-paced system interaction and a concurrent presentation of audio and visual information for the audio/visual system. The RepGrid analysis also suggests a priority of short and concise information over longer detailed information when analysing a stock's performance historically and its comparison to peers. Results from the RepGrid analysis also revealed a disinclination amongst participants towards the successive display of audio/visual information and system-paced interaction.

In testing retention and transfer of information, it was initially predicted that the combination of concurrent and related audio/visual investment information would allow participants to retain and transfer information more effectively than participants receiving solely visual investment information. This would be consistent with the modality effect which states that learning is enhanced when related audio/visual information is processed concurrently. This study examines whether or not the modality effect can enhance the ability of retail investors to learn from investment-related information and improve subsequent investment decisions. The opposite was observed, with participants receiving solely visual investment information outperforming participants who received concurrent and related audio/visual investment information in both retention and transfer. This finding is referred to as a reverse modality effect. This implies that an investor's ability to learn from investment-related information is impaired when information is provided in an audio/visual format and will result in subsequently less informed investment decisions. Further evidence that investor decisions are diminished by audio/visual information is suggested by the quicker response times of participants in the Audio/Visual Test Group. While quicker to process information, lower retention and

transfer scores are observed. This suggests that investors processing audio/visual information are less accurate when transferring and retaining this information. Given this information is intended to be retained and transferred to inform an investment decision, this trade of accuracy for quicker responses can be at the expense of less informed decisions.

Based on previous literature it is plausible that these findings can be attributed to the inclusion of visual cues. Visual cues were used primarily with numerical, text-based information onscreen; for example, a decrease in price percentage change was displayed with red font and an increase in price percentage change was displayed with green font in both the visual and the audio/visual POC. Market capitalisation and revenue figures were highlighted using bold font. The intention of these visual cues was to reduce the visual search for participants. Considering the use of visual cues was associated primarily with numerical information, i.e. percentage changes in price, market capitalisation and revenue figures, it is reasonable to consider the presentation of numerical information to be more beneficial and effectively processed when presented visually. The audible information presented to the Audio/Visual Test Group contained a substantial amount of numerical information relative to what was displayed onscreen. Audible information regarding market capitalisation, revenue and news were largely numerical; the lower test scores for retention and transfer of information for the Audio/Visual Test Group could be to a certain extent, attributable to this. In order to improve the performance of the Audio/Visual Test Group, all numerical information could be presented onscreen using visual cues, supplemented by relevant audible information.

It is also plausible that these findings can be attributed to insufficiently short and concise information. The intention of the audio/visual POC was to provide audible information that was as short and concise as possible, but sufficient for participants to answer questions appropriately during testing. Despite this, responses from Alexa averaged 37 words in length to provide full answers to each participant's question. While the intention was to provide short and concise audible information, it is plausible that 37 words per answer is excessively long regardless of complexity. This finding is consistent with the reverse modality effect which, in the context of this study, suggests that longer, audible information impairs an investor's ability to learn

from investment-related information and results in less informed investment decisions. With this in mind, it is reasonable to emphasise that in the context of retail investor decision-making, for audio/visual information to be effective, audible information must be shorter in length than in this study's testing scenarios. It is also plausible that audible information may be effectively used as a supplement to text, reiterating certain important pieces of visual information instead of presenting the information in a solely audible mode.

One noticeable limitation of this study is the use of the RepGrid analysis as an interviewing technique. While the RepGrid analysis has been considered as applicable and beneficial in the context of information systems (Bernard & Flitman, 2002), the interviewing procedure requires participants to recall experiences and preferences with familiar systems. This study derived requirements from this feedback and built system features and functionality accordingly. Considering the recency of voice assistant technology and its relatively unexplored use in the context of retail investing, RepGrid participants are more likely to inform what system features are preferred when using a more familiar visual system. Perhaps in order to identify additional benefits of audio/visual systems in a retail investing context, features identified as beneficial outside the context of retail investing should be considered. The discussion of this limitation is intended to suggest directions for future research and shed light on areas and methodologies to further explore findings.

8. Conclusion

From a practical implication perspective, this study identifies that following further research and refinements, the inclusion of audible information to retail investment platforms is an area of significant potential. The audible information used in this study was found to be excessive in length despite efforts to remain as concise as possible. The length of audible information needs to be further reduced. Similar findings were noted during the study regarding numerical information. Numerical information was regularly presented audibly; however, it was shown to be more effective when presented visually. This suggests that for audible information to be presented and processed effectively, non-numerical audible information should be used to supplement visual numerical information highlighted with visual cues. From the

perspective of future research, this chapter helps researchers understand the effect multi-modal information has on an investors decision-making process. This chapter adds to previous research undertaken by investigating the modality effect in the context of retail investing which had not been explored. In summary, a major advance in this study was determining the inferiority of audible information over visual information with retail investors. However, these findings should not be taken as a rejection of the use of audible information with retail investors. Future research can make adjustments in information length and the priority of non-numerical, audible information could be of significant benefit when designing future systems and could lead to interesting and applicable findings following further research.

Another interesting finding of this study highlights how the inclusion of audible information results in quicker response time among investors. This tendency among investors to make quicker decisions suggests increased confidence in the information received, however, is at the expense of less informed and perhaps erroneous investment decisions

Chapter 4: Impact of Social Media on Trust in Millennial Investors

Abstract

Social Media provides investors with easy access to the opinions and recommendations of other users on the platform. For the investor, determining which information they view as trustworthy can often be difficult. Each individual investor has their own reasons for deciding to trust the information available or to dismiss it. This study examines the key trust factors of Twitter when used for making financial decisions. This research focuses on the development of trust between an investor and the information they view on Twitter. To conduct this research, a workshop was undertaken with millennial investors, who are the key users of this platform. Each participant was asked to make a financial decision based on three Twitter profiles presented to them. Analysis of the results of this workshop highlighted two important factors. The research found, that when millennial investors use Twitter to view financial information, the number of Followers and Retweets are the most important considerations when developing trust in the information provided. When searching for financial information on Twitter, the study also revealed that Millennial investors are not as thorough as they should be when examining investment information available to them. The findings of this research also showed the millennial investors are less likely to trust information that originated from and unverified Twitter profile.

1. Introduction

This chapter examines the final research question of this thesis which is how online investors establish trust in the information they look at. Traditionally, consumers and investors would have dealt with trusted individuals such as 'Brick and Mortar' stores, and stock brokers (Bakos, 2001). These traditional methods came under threat with the emergence of the internet providing easier, cheaper, access to information search and trade (Habibi, Laroche, & Richard, 2014). Online investing grew rapidly, with 43 million online brokerage accounts being opened by 2003 (Vlastakis & Markellos, 2012), and 600 million internet users by 2006 (Coffman & Odlyzko, 1998; Zook, 2006). In order to capitalize on this massive customer base, traditional businesses and stock traders had to develop a trust relationship with potential customers. Insurance firms and mutual funds were slow to move online, whereas banks and, more extensively, securities brokerage firms were the leading adopters of Internet technology (Unsal & Movassaghi, 2001). In order to entice consumers to use their product, these online platforms had to develop a method of establishing trust for the end user (Holmes, 1991; Komiak & Benbasat, 2006)

Developing trust in the online environment is difficult; an example of this is e-commerce sites where consumers are expected to provide sensitive financial details in order to make a purchase. To create trust, companies such as eBay and Amazon provide the user with the ability to view reviews on the products they were interested in. These reviews help to develop a reputation for the product by showing potential consumers the experiences of previous buyers; the user can use these reviews to develop a degree of trust in the product (Riedl, Hubert, & Kenning, 2010). A higher level of trust was expected by online buyers due to the financial risk they were undertaking when providing their financial details (for example credit card) for an online purchase.

Social Media had a large disruptive impact in the late 2000's, with sites such as Facebook and Twitter reaching millions of users by the turn of the decade. Twitter reached 18.2 million users by 2009, and Facebook surpassed 1 billion accounts by 2012 (Fattal, 2012). Today, Facebook is predominantly used by adults over the age of 35, while Twitter is more for 'millennials' between 18-35 (Sloan, Morgan, Burnap, & Williams, 2015). These millennial investors are more comfortable using social media

as they grew up with these platforms. Which specific aspects of these platforms make them reliable and trustworthy for these individual investors remains to be investigated.

This chapter focuses on trust in the context of how individual millennial investors who use social media build trust in the information they see. This area of trust was chosen due to the relative infancy of social media in the context of investment, compared to the mature online investing market (Habibi, Laroche, & Richard, 2014). With social media being accessible through mobile devices, investors can digest financial information at their ease (Cade, 2018). The sheer volume of information on social media also makes examining how individuals decide which financial information is relevant or not an interesting research topic. Traditionally, trust has been researched in investment in bricks and mortar companies; the use of social media has blurred the understanding of trust. The aim of this study is to determine which features of social media platforms, specifically Twitter, individual investors regard as important when developing trust in stock advice from Twitter users who provide financial information and recommendations. During this study, a workshop was undertaken with millennial investors to determine which features of the social media platform are the most important when using it to make an investment decision. These features are key in establishing trust between the investors and the information they use. This chapter conducts a literature review on both trust and social media. The literature review was used to analyse the research previously conducted on trust and social media and determine how this study can investigate their relationship amongst millennial investors. Following this review, the method for conducting the workshop with the investors is outlined. Results of this workshop are then analysed to determine what features these millennial investors view as important for establishing trust in social media information.

2. Trust and Social Media

To complete a comprehensive literature review in the context of Trust and Social Media, this research followed the guidelines of Webster and Watson (2002). The steps carried out for this literature review follows the method used in chapters 2 and 3 in this thesis. These steps are as follows: investigation of leading journals and journal databases, backward review, and forward review.

The article databases that were used for this research were the AIS Electronic Library, EBSCO, Google Scholar, ScienceDirect, and SSRN. They were explored using the following keywords: Trust, Trust in financial services, Social Media, Trust Social Media. In addition, high impact journals were searched: MIS Quarterly, Journal of Applied Corporate Finance, The Economic Journal, The Journal of Finance, The Journal of Behavioural Finance, and International Journal of Information Management. The input of these keywords into the databases returned 30 articles where the title appeared to be relevant. Each relevant study's abstract was then examined and determined if they were applicable to the research; this removed 8 articles deemed to not be relevant.

The backwards review examined the citations in the articles identified during the initial search. The keywords were again used to evaluate the literature. Reviewing the citations of articles from the initial search facilitated the chronologically backwards investigation of articles within the scope of the review. A forward review consisted of using the Web of Science and Google Scholar to identify studies that cite the key articles identified in the previous steps. The same keywords were applied to the research. Results of this review provided 48 initial articles for examination. 26 from the initial search, 10 from the backward review, and 12 from the forward review. The analysis of this review of the literature on trust and social media is presented below.

Trust plays a central role in the way in which financial organisations present themselves to potential investors (Ennew & Sekhon, 2007). Berry (1995) discussed trust as the bond that holds the relationship between the buyer and seller together. When risk is present, trust is the crucial factor that helps to mitigate uncertainties and risks for investors (Corbitt, Thanasankit, & Yi, 2003). Investors facing high levels of risk in their investment decisions needed to trust their financial institutions.

The relationship between customers and financial institutions underwent a rapid change when the Internet age dawned in the late 1990's. Web based information search became increasingly popular instead of seeking a financial advisor or examining paper-based information (del Águila-Obra, Padilla-Meléndez, & Serarols-Tarres, 2007). This increased access to information provided additional risk to the end investor due to the increased access to false or incorrect information that could result in a poor financial decision (Jarvenpaa, Tractinsky, & Vitale, 2000). Financial services had to

adapt to this new information medium, inserting themselves as a reliable source of information to the investors (Murphy & Blessinger, 2003). A greater level of trust was required for the online environment, especially when compared to the physical environment which had investment branches and face-to-face interaction (Van der Heijden, Verhagen, & Creemers, 2003). Initially, many investors were hesitant to trust online service providers as sharing sensitive financial information over the internet was not viewed as secure, leaving personal information susceptible to cyber-attacks and theft (Pavlou & Gefen, 2004). Trust had to be developed to enable a leap of faith in the provider and allow a relationship to form (Colquitt, Scott, & LePine, 2007; Cook, Hardin, & Levi, 2005). Research has shown that the key factors for trusting the information investors obtained was the perceived usefulness/utility of the information provided, how reliable this information was to the investor, and the accuracy of the information (Cyr, 2008; Pavlou, 2003). When investors can rely on the reputation of the information source, this would reduce risk and increase trust (Luo, Zhang, & Duan, 2013).

Reputation is the opinion an individual has about something, and it is an important trust building factor for all online consumers, including investors (Fung and Lee, 1999). This is especially true in the initial trust building phase. Since consumers do not have personal experience with a vendor, word of mouth reputation can be key to attracting customers. Hearing from someone else that interacting with an online investment service was a positive experience can help alleviate users' perceptions of risk and insecurity of using online services (McKnight, Choudhury, & Kacmar, 2002). Public perception is also a contributing factor to establishing trust in a financial service (Mudambi & Schuff, 2010). Customer reviews are extremely helpful in creating a positive perception. This method is seen with Amazon's product review section, which allows customers to provide feedback on items they have bought. This review either increases or decreases the products reputation as seen in Luo et al. (2013)'s research describing how web traffic and buzz (customer reviews) were important factors that contributed to a firm's stock market performance. In the early 2010's, the rise of social media allowed users to express their views on certain companies and products, including potential investments (Blankespoor, 2018). The question remains, though, as to why the investor should trust the information that they view on social media platforms when making financial decisions.

Social media is broadly defined as the use of online communities that are developed on electronic platforms that users can communicate through (Carroll & Bruno, 2016). Sites such as Facebook, Twitter, Instagram, LinkedIn all gained massive popularity at the beginning of this decade (Duggan, Ellison, Lampe, Lenhart, & Madden, 2015; Jagongo & Kinyua, 2013). A study conducted by Carroll and Bruno (2016) found that almost 75% of adult Internet users use social media. The Financial sector has been heavily influenced by these new platforms (Cade, 2018). These businesses see the financial benefit from being active on social media as a way to influence others' perception of their firm instead of these investors relying on other individuals for advice (Lovejoy & Saxton, 2012; Miller & Skinner, 2015). Financial Services have predominantly adopted social media to increase Business-to-Customer (B2C) interaction and discussion. Blankespoor (2018) outlines in her research that financial services have predominantly adopted social media to increase B2C interaction and foster relationships and trust that is not possible through web-based information. Each social media platform has a different level of B2C interaction. For example, user response to firm disclosure on Twitter is faster than on Facebook, but user engagement with a post continues for longer on Facebook than on Twitter (Zhou, Lei, Wang, Fan, & Wang, 2015). Social media enables firms to personalize disclosures for each customer; Elliott, Grant, and Hodge (2018) discusses how investor trust is increased if the disclosure appears to be coming from management. Cade (2018) reveals in her research how 84 percent of sampled U.S. firms had a corporate Twitter account and, in a global sample, 70 percent of firms with corporate accounts had a history of tweeting investor relations content. The advantage of developing a personal connection with the investor is that they are increasingly likely to listen to your recommendation as opposed to others. However, millennial investors are no longer relying on financial organisations for their investment information. Instead, they are relying on the opinions of others on social media (Ivković & Weisbenner, 2007). On social media, most investors seeking financial information are millennials. This increases the chances of millennial investors opinions being heard by other millennial investors who use the same platforms, as opposed to hearing the opinions of traditional financial organisations (Chen, De, Hu, & Hwang, 2014). Previous research has revealed that the majority of individual/retail investors are more inclined to follow other investors, as opposed to institutional advice and traditional financial news outlets (Agarwal, Kumar, & Goel, 2019; Ordanini, Miceli, Pizzetti, & Parasuraman, 2011).

Social media sites such as Twitter and Facebook provide an opportunity for individuals to learn opinions of other investors about specific stocks or the whole stock market, and develop social bonds with others (Agarwal et al., 2019). When a relationship is created, it generally causes individuals to develop more enduring trust in the other individual using the same platform, which creates a level of trust in the social media platform itself (Haslam & Ellemers, 2005; Lewicki & Bunker, 1996; Shapiro, Sheppard, & Cheraskin, 1992). This reliance on other investors using social media reveals a lack of trust of financial news outlets on the social media as there is limited opportunity to develop a trusting social bond with these outlets. Ridout (2013) shares a similar sentiment, finding that trust in social media is at its highest when the public holds low levels of trust in the mainstream news outlets.

For the purpose of this research, Twitter will be the social media of choice. This decision was based on the consensus throughout the literature that it was the most trusted platform of communication for both the Financial Sector and the Individual Investor – a non-institutional retail investor (Ruan, Durresi, & Alfantoukh, 2018; Sul, Dennis, & Yuan, 2017). Twitter is one of the most popular social media platforms for investors, with numerous analysts, professional and amateur investors using Twitter to post news articles and opinions. They also provide information and comments on the investment market more frequently than the professional news media (Sprenger, Tumasjan, Sandner, & Welpe, 2014). While the relationship of Twitter and the financial markets is in its infancy, there has been an increasing amount of academic research surrounding this research area.

Previous studies have examined the impact of Twitter on the financial markets. The majority of these investigate public mood or 'Sentiment' on the platform, which can be an important factor in whether an individual trusts an opinion (Agarwal et al., 2019). Various techniques have been used to examine this Sentiment, with varying results. Examining the content of tweets using sentiment analysis has shown a strong correlation between Twitter posts and stock market performance (Si et al., 2013; Souza & Aste, 2016), while conversely some have failed to reveal any causative relationship (Bollen, Mao, & Zeng, 2011). Positive sentiment is more likely to induce individuals to make a decision than negative sentiment, which tends to slow the decision process as negative sentiment makes the individual reassess their decision as opposed to confirming it (Simões Vieira, 2011). Positive sentiment may also induce an individual

to act on a decision (Frijda, 1993). Research into investor sentiment that conducts studies using Twitter is interesting because 'retweets' enable users to rapidly share views and opinions with people who follow them, allowing analysis of the spread in sentiment and development of social bonds through the platform (Sul et al., 2017).

Previous research has examined Twitter through the lens of stock returns and sentiment. The examination of which specific Twitter profile features are important to the end investor for building trust has not been fully explored yet but there have been call for such investigation. In their research, Sul et al. (2017) conclude their study by calling for research into retweets. Specifically, they ask if retweets appear to be more important and therefore get more attention. They also call for research to determine if retweets are more likely to influence behaviour, and in turn establish trust in the information provided? Along with retweets, other aspects of Twitter have the potential to impact on trust from an investors point-of-view. Features such as 'Comments', 'Likes' and the overall profile of the Twitter profile have the potential to impact. How do these features effect the development of investor trust on Twitter? This is the research question that will be investigated during this study.

3. Testing Method

To determine which aspects of Twitter information millennial investors trust, an experiment was carried out. A workshop was conducted with millennial investors to examine specific aspects of a Twitter profile to gauge what information impacts on the investor's development of trust. Millennials are defined as any individual born between 1980-2000 (DeVaney, 2015).

3.1. Workshops

Previous studies investigating investor trust on social media have use different methods and techniques such as the Happiness Index (Brooks, 2015; Karabulut, 2013) and Sentiment Analysis (Kušen & Strembeck, 2018; Smailović, Grčar, Lavrač, & Žnidaršič, 2014). While previous methods have gathered data on trust at a higher level, this study will use workshops to focus specifically on the features of twitter that create trust. Conducting workshops in this research allow more control of the data presented to participants and ensures all participants are within the scope of the research (Bryman & Becker, 2012). in this case, the participants were millennial investors. In this research, the aspects of the information mode that investors value are observed

with the investors expanding upon their choice. Raghubir and Das (1999) discuss how conducting experiments are important to complement existing models and field research. They argue that research conducting an experiment is the most suitable methodology for singling out specific causes of behaviour and for complementing existing approaches.

In this research, the experiment conducted was designed to reveal which specific aspects of information available on Twitter profiles lead to an increased level of investor trust in the financial information provided. Twitter profiles were created based on an amalgamation of actual Twitter profiles. This was done to ensure profiles with relevant details for the experiment. This experiment presented both a fictional stock and 3 fictional Twitter profiles with the goal of determining the impact of the profiles on trust and decision making on the stock. 20 millennial investors were specifically chosen for the experiment. All the participants had a minimum of 3 years investment experience with a minimum investment of €500. The age group was established due to Sloan et al. (2015)'s research indicating that just under 85% of all Twitter users were aged 30 or below.

3.2. The Test

This experiment was conducted in a group environment to gather responses as efficiently as possible. Each person was provided with a fictional stock (STK:ATC) that contained information in the form of written text and a graph representing the stock

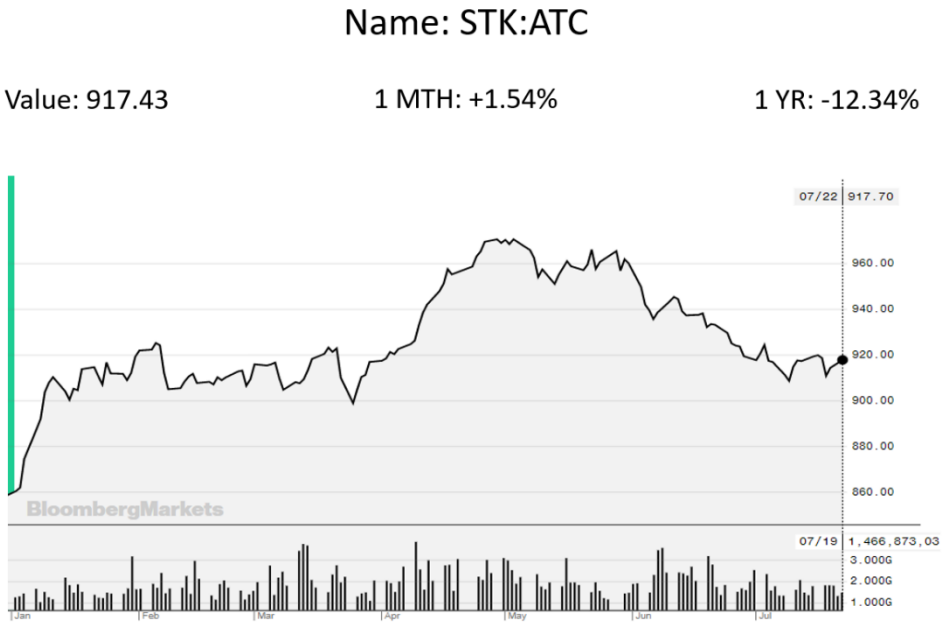

Figure 12: Fictional Stock ATC.

The participant was given time to examine this stock before they were presented with 3 differing fictitious Twitter profiles (Figures 13-15) that were discussing the stock. Along with the profile information, 10 tweets by each person were provided to participants. Each tweet was unique and was either related to the financial markets or simply provided general information. The intention was to accurately portray a typical Twitter profile. The participants were then advised of the scenario where they currently owned shares in this stock and must use all information provided to them to make one of three choices: Buy; Sell; or Hold their shares. All profiles gave a different recommendation as regards what to do with the fictional stock. Each participant was given time to read all information provided and make their decision. For the participants to properly share their decision, an answer sheet was provided. This answer sheet asked participants:

- Buy/Sell and the reasoning for that decision
- Which Twitter profile they trusted more
- What key features of each profile made them trust the information provided.

Once the answer sheets were collected, participants filled out an exit questionnaire for feedback on the test and what improvements could be made in future experiments.

3.3. Workshop Information

As shown in the figures below, each profile is different. Alongside these profiles, a selection of Tweets was provided to each participant. These tweets ranged from general observations, financial news, to stock recommendations.

Twitter Profile 1. Harold is verified, which lets people know that this account is deemed to be authentic by Twitter itself. The profile has over 80,000 previous Tweets and a following count at 75,700.

Figure 13: Twitter Profile 1

Twitter Profile 2. Max is a verified account. Max has tweeted almost 20,000 times. He has a professional profile photo, and a large following of over 118,000.

Figure 14: Twitter Profile 2

Twitter Profile 3. Stephen is not a verified account. Stephen has 18,400 tweets. Stephen's Bio is more personal than the other two provided, giving insight into the type of person Stephen is. His profile photo is professional, and his Bio is adequately completed.

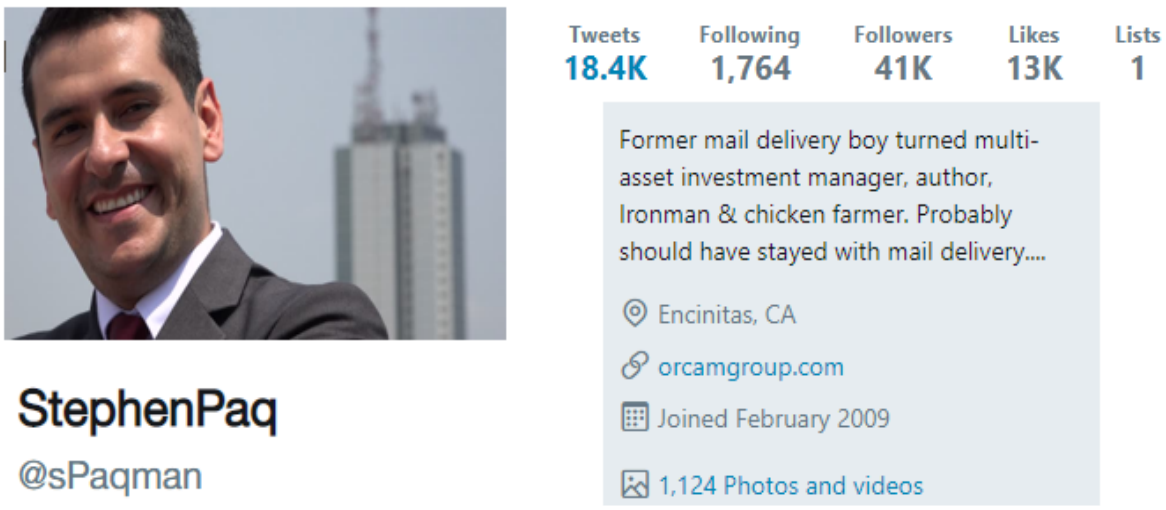

Figure 15: Twitter Profile 3

4. Results

Once the experiment was completed, the answer sheets were collected and analysed. This section presents the results of this analysis following the workshop with individual millennial investors that focused on the development of trust in social media information, specifically using the social networking platform Twitter.

4.1. Key Twitter Features:

The workshop required the participant to choose to either Buy; Sell; Hold their shares in Stock A. A total of 20 individual investors took part in this experiment. Table 7 outlines the comments of the participants on the information they had looked at.

Twitter features:	**Comments**
Follower Number	'If someone is giving good advice, they will gain followers, while you can fake bios, etc.' 'Number of followers is the most important' 'Followers is the main one I look for' 'Harold has a respectable following' 'Harold has thousands and appears to be the most knowledgeable profile'
Retweets	'More retweets suggest more investors agree with Steve despite his page having less followers' 'Stephens tweet has the most reaction such as retweets meaning more people agreed compared to the other two.'
Likes	'The likes and retweets are the most important as they reveal the sentiment of others' 'Likes/ retweets/ followers are good to get a feel for how certain groups think about an investment'
Verification	'Being verified is also very important as I can trust the recommendation more'

	‘Being verified is preferable but you can be wrong even if verified’ ‘Least qualified investor/reputable (no verification) suggested selling’

Table 7: Participant comments on the information provided during the workshop.

Following the analysis of the data, the number of followers was determined to be the most important piece of Twitter information to the investors, with 16 people mentioning this as the primary feature examined. The second most important information to investors was the number of retweets, with 10 participants stating they heavily valued the retweet amount of stock recommendation tweets when making their decision. The third most important Twitter feature for investors was Likes and Profile Verification with 8 mentions. Twitter Profile Bios came in at fourth with 6 people viewing this as important when trusting a profile. Table 7 above provides the comments the participants made as to why each feature of Twitter was important for trusting the information that was provided to them.

4.2. Investor Diligence:

The participants were asked if they read all the Tweets provided to them in detail. This question was asked to discover if Tweet history was important to the investors.

10 participants mentioned they read every Tweet in detail to get a better understanding of the person so they could trust their decision. 7 participants only read the first few Tweets to get a feel of the person and whether the information they provided was beneficial. 3 participants described skimming through the tweets that mentioned the fictional stock and disregarding the rest.

5. Discussion

The findings of this chapter contribute to the gaps in the extant literature that were identified while creating CCM. In previous literature, calls were made to examine the impact ‘Retweets’, ‘Comments’, and ‘Likes’ had on establishing investor trust in the information provided on Twitter. The results from the workshop reveal several insights into the key information millennial investors trust in relation to Twitter. The *number of followers* a profile had was the primary reason a participant trusted the investment recommendation. Supporting the findings of existing literature examining trust on social media, reputation is shown to play a large role in developing initial

trust in an online environment (Mudambi & Schuff, 2010). The number of followers a profile has allows the investors to trust the information available as it establishes a good reputation for the information source.

In tandem with reputation, the *number of retweets* on the stock recommendation was also viewed as important information. This shows that investors want to see what others think about an investment decision before deciding for themselves as it adds validation to their choice. By retweeting a recommendation, this shows that others are agreeing with it.

Likes and Verification were viewed as equally important information to participants. This was taken into consideration when making an investment decision as the investors had no way of knowing if the Twitter profile was a trustworthy source of information, even if the recommendation had the most likes. Twitter verification lets people know that this account is deemed to be authentic by Twitter itself. This verification was important to participants as it offers a level of security and a reduction of risk for the investor, as unverified users were not seen as authentic by Twitter itself. These findings build on previous research that examined the risk in the development of trust when making an investment decision (Berry, 1995; Corbitt et al., 2003) and show that risk is also relevant for trust in financial information on Twitter.

The practical implications of this research are that Twitter users that offer investment information to millennial investors need to understand the importance of the number of retweets and followers to these millennial investors. This is important when deciding whether to trust the investment information provided to them. The number of followers a profile has and the number of retweets they gain per Tweet are the most important information for millennial investors when developing trust on the social media platform. Of course, this finding could be misused with the steady growth of bot accounts or through buying retweets to sway a potential investor into trusting the information they view.

From a research perspective, the findings provide insight into how millennial investors develop trust on social media platforms. This research is also consistent with previous studies that state reputation is a major factor for investors when developing trust on social media. This research adds to these previous studies by finding the importance

of retweets and followers to millennial investors when developing trust on social media.

6. Conclusions and future research

This chapter presents a study that determines the Twitter information that investors rely on to establish trust. Previous studies examined the development of trust in online transactions and social media as a whole (Barber & Odean, 2001; Brooks, 2015; Carroll & Bruno, 2016). This study adds to this existing literature of trust through the findings of the workshops which reveal the key trust factors for millennial investors when they look for financial information on the social media platform Twitter.

This study reveals key insights into millennial investors and how they develop trust on social media platforms. Overall, millennial investors put their trust in the reputation of the information they were using to make their financial decisions. This reputation was created by the number of Followers and Retweets a Twitter profile had. The higher the Retweets and Follower count was, the more likely the millennial investors were to trust the information. A Twitter profiles verification status also played a role in developing trust for the millennial investors. The source of information had a better reputation if the Twitter profile was verified. For people providing financial information, these findings show the importance of developing a reputation on social media platforms.

This study also found that millennial investors are quick to trust financial information they view on social media. Many participants made their financial decision without reading all the information that was provided to them. This finding is important as it reveals that millennial investors are not as thorough when making financial decisions. This can lead to incomplete information which negatively impacts an investors ability to generate maximum profit from their investment decisions.

Following on from this research, further studies can build on the findings of this chapter, focusing on other social media platforms and investigating what information millennial investors deem important when developing trust on the different platforms. Future research can examine how the findings from this study could be manipulated to create a false perception of a stock. One example is the Twitter bots mentioned previously. Bot accounts can help gather false retweets and likes on certain tweets that are aimed at guiding millennial investors in a specific direction. A negative example

of this could be promoting Tweets to try to obtain investment in a certain cryptocurrency. This cryptocurrency may not be legitimate and if an investor decided to invest based on the false information found on Twitter, this investor can lose the majority of, if not all, of their investment.

Chapter 5: Conclusion

This thesis contains the work I completed during the 12 months I spent while studying for a research master's in the area of financial technology. The focus of my research in the Statestreet Advanced Technology Centre in UCC was to investigate online investing, specifically examining three research questions that focused on understanding the relationship between investors and the information they use for financial decisions.

5.1. Research Findings:

The objective of this research was to explore online investing and to better understand the relationship between the investor and the information they used. The research questions that were investigated throughout chapters 2-4 were;

Research Question 1: What draws investors to use online investing platforms such as Social Trading?

The objective of Chapter 2 was to determine online investors' intention to engage in social trading. A model was produced, the Investor Engagement Framework (IEF), that highlighted what draws investors to engage in online social trading. Firstly, the framework identifies that imitation, risk management, and return on investment enhance investor performance, therefore increasing the perceived usefulness of copy trading. Secondly, the framework highlights that transparency, experience level, reduced overtrading, and reduced fees drive perceived ease of use. This suggests that copy trading appeals more to investors when it is perceived to be free of effort. Thirdly, the framework suggests that self-attribution, the illusion of knowledge and illusion of control make copy trading more enjoyable for investors regardless of the investment outcome.

Finally, the framework includes signal provider trustworthiness as an additional core construct which mediates the relationship between TAM's core constructs and an investor's intention to engage in copy trading. The inclusion of signal provider trustworthiness builds on TAM's core constructs in the specific context of copy trading. This trustworthiness is broken down into two separate forms of signalling: cognition based-signalling and affect-based signalling. The framework shows that

when delivered effectively, cognition-based signals and affect-based signals of trustworthiness form the trust necessary for investors to engage in copy trading.

While usefulness, ease of use, enjoyment and signal provider trustworthiness are highlighted individually as core constructs of investor engagement in copy trading, the framework's overall contribution is that the core constructs and their underlying drivers must work interdependently. It is considered that an investor's intention to engage in copy trading is nullified when any of the core constructs or their underlying drivers are absent

Research Question 2: Through what information these investors are using to invest online?

Chapter 3 contributes several findings to the evaluation of information modality in the context of retail investors. Through a RepGrid analysis with key informant interviews, preferable system features and requirements were gathered to build a POC for testing. This study examines whether or not the modality effect can enhance the ability of retail investors to learn from investment-related information and improve subsequent investment decisions. The opposite was actually observed, with participants receiving solely visual investment information outperforming participants who received concurrent and related audio/visual investment information in both retention and transfer. This finding is referred to as a reverse modality effect. This implies that an investor's ability to learn from investment-related information is impaired when information is provided in an audio/visual format and will result in subsequently less informed investment decisions. Further evidence that investor decisions are diminished by audio/visual information is suggested by the quicker response times of participants in the Audio/Visual Test Group. While quicker to process information, lower retention and transfer scores are observed. This suggests that investors processing audio/visual information are less accurate when transferring and retaining this information. Given this information is intended to be retained and transferred to inform an investment decision, this trade of accuracy for quicker responses can be at the expense of less informed decisions.

Based on previous literature it is plausible that these findings can be attributed to the inclusion of visual cues. Visual cues were used primarily with numerical, text-based information onscreen; for example, a decrease in price percentage change was

displayed with red font and an increase in price percentage change was displayed with green font in both the visual and the audio/visual POC. Market capitalisation and revenue figures were highlighted using bold font. The intention of these visual cues was to reduce the visual search for participants. Considering the use of visual cues was associated primarily with numerical information, i.e. percentage changes in price, market capitalisation and revenue figures, it is reasonable to consider the presentation of numerical information to be more beneficial and effectively processed when presented visually. The audible information presented to the Audio/Visual Test Group contained a substantial amount of numerical information relative to what was displayed onscreen. Audible information regarding market capitalisation, revenue and news were largely numerical; the lower test scores for retention and transfer of information for the Audio/Visual Test Group could be to a certain extent, attributed to this. To improve the performance of investors using a combination of Audio and Visual information, all numerical information should be presented onscreen using visual cues, supplemented by relevant audible information.

Research Question 3: How online investors establish trust in the information presented on social media?

Chapter 4 examined how social media impacted on millennial investors' development of trust in financial information. This question examined the social media site Twitter and the key information available that helped millennial investors establish trust on that platform. The results from the workshops revealed several insights into the key information millennial investors trust in relation to Twitter. The *number of followers* a profile had was the primary reason a participant trusted the investment recommendation. The number of followers allows the investors to trust the information available as it establishes a good reputation for the information source. In tandem with reputation, the *number of retweets* on the stock recommendation was also viewed as important. This shows that investors want to see what others think about an investment decision before deciding for themselves as it adds validation to their choice. By retweeting a recommendation, this shows that others are agreeing with it.

Likes and Verification were viewed as equally important information to participants. This was taken into consideration when making an investment decision as the investors had no way of knowing if the Twitter profile was a trustworthy source of

information, even if the recommendation had the most likes. Twitter verification lets potential investors know that this account is deemed to be authentic by Twitter itself. This verification was important to participants as it offers a level of security and a reduction of risk for the investor, as unverified users were not seen as authentic by Twitter itself.

5.2. Research Implications:

Chapter 2's findings have implications for practitioners. Understanding what impacts trust among investors in copy trading is important in the development of strategic and technological advancements to increase investor satisfaction and outcomes. The framework created in this thesis suggests that platform providers and marketers should identify and emphasise the features that users find easy to use, benefit from, and enjoy: for example, increased returns as a result of copy trading. Finally, the framework shows that platform and signal providers must emphasise the availability of signal providers' personal information and performance information to build trust with investors.

From a research perspective, this chapter's framework helps researchers understand the drivers of online investors to engage in copy trading and delegate their investment decisions to others online. The framework is based upon TAM's core constructs. However, this chapter extends TAM with the introduction of signal provider trustworthiness as an exogenous factor and by identifying drivers of the core constructs. Signal provider trustworthiness mediates the relationship between investors' decisions to engage in copy trading and TAM's core constructs of user acceptance. Therefore, the framework emphasises the importance of building trust between participants in copy trading.

From a practical implication perspective, Chapter 3 identifies that following further research and refinements, the inclusion of audible information to retail investment platforms is an area of significant potential. This potential is as yet unrealised if audible information is simply "bolted on" to visual information. Audible information was found to be excessive in length despite efforts to remain as concise as possible. The length of audible information needs to be further reduced. Similar findings were noted during the study regarding numerical information. Numerical information was

regularly presented audibly; however, it was shown to be more effective when presented visually. This suggests that for audible information to be presented and processed effectively, non-numerical audible information should be used to supplement visual numerical information highlighted with visual cues. In summary, a major advance in this study was determining the inferiority of audible information over visual information with retail investors. However, these findings should not be taken as a rejection of the use of audible information with retail investors. Adjustments in information length and the priority of non-numerical, audible information should be of significant benefit when designing future systems and could lead to interesting and applicable findings following further research. Another new finding of this study highlights how the inclusion of audible information results in quicker response time among investors. This tendency among investors to make quicker decisions suggests increased confidence in the information received; however, it is at the expense of less informed and perhaps erroneous investment decisions.

The practical implications of research conducted during Chapter 4 is that Twitter users that offer investment information to millennial investors need to understand the importance of the number of retweets and followers to these millennial investors. This is important when deciding whether potential investors trust the investment information provided to them. The number of followers a profile has and the number of retweets they gain per Tweet are the most important information for millennial investors when developing trust in the financial information provided on social media. Of course, this finding could be misused with the steady growth of bot accounts or through buying retweets to sway a potential investor into trusting the information they view. Bot accounts and their impact are discussed in more detail in the future research section below.

5.3. Research Limitations:

Chapter 3 had two noticeable limitations with regards the primary data gathering technique. While the RepGrid analysis has been considered as applicable and beneficial in the context of information systems, the interviewing procedure requires participants to recall experiences and preferences with familiar systems. This study derived requirements from this feedback and built system features and functionality accordingly. Considering how new voice assistant technology is and its relatively

unexplored use in the context of retail investing, RepGrid participants are more likely to inform what system features are preferred when using a more familiar visual system. The other limitation was the sample size for both interview techniques. Ideally more retail investors would have been preferable to test the modality effect, although this was accepted as the use of key informants provided more expert opinions. In Chapter 4, the platform of choice was a limitation of the research. While Twitter is the preferred social media platform for millennial investors, the many other platforms, such as Reddit, cannot be discounted and provide an opportunity for further research.

5.4. Future Research avenues:

Through the research conducted in this thesis, each chapter provides opportunities to further expand the field of literature in the area of online investing.

The Investor Engagement Framework created in this thesis, provides areas of future research. To further understand what drives user acceptance of copy trading, future research could explore which specific features of this framework have the most significant effect on user intentions to engage in copy trading and intentions to delegate investment decisions to others. While objectives generally vary from investor to investor, an attempt could be made to filter out less significant factors in engaging in copy trading to further refine the framework presented in this study.

The modality effect, and the POC created for this thesis, provides future research with a suitable foundation when examining the modality effect and its relationship with retail investors. In line with the findings of this research, adjustments in information length and the priority of non-numerical, audible information could be of significant benefit when designing future systems and could lead to interesting and applicable findings following further research. Another potential future research avenue is to identify additional benefits of audio/visual systems in a retail investing context; features identified as beneficial outside the context of retail investing should be considered. The discussion of this limitation is intended to suggest directions for future research and shed light on areas and methodologies to further explore findings.

Future research opportunities could focus on other social media platforms and investigating the information millennial investors deem important when developing trust on the different platforms. Future research could also examine how the findings

from this study could be manipulated to create a false perception of a stock. One example is the Twitter bots mentioned previously. Bot accounts can help gather false retweets and likes on certain tweets that are aimed at guiding millennial investors in a specific direction. A negative example of this could be promoting Tweets to try to obtain investment in a certain cryptocurrency. This cryptocurrency may not be legitimate and if an investor decided to invest based on the false information found on Twitter, this investor can lose the majority of, if not all, of their investment.

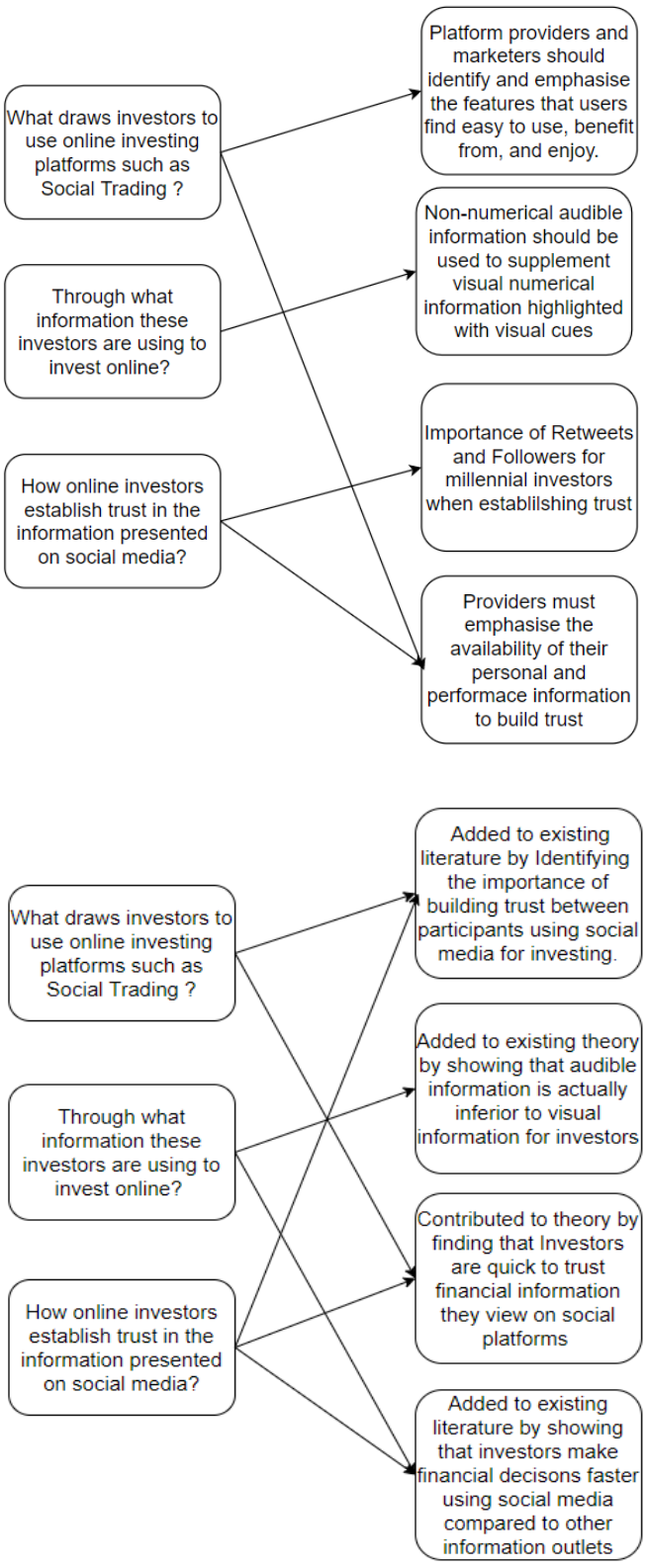

Figure 16: Contribution to both practice (top) and research (bottom)

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Appendix 1: Modality effect tests

Below are the test questionnaires that were used for Chapter 3. In order, they are: Retention, Transfer, Satisfaction.

What was the price of stock 1?

What is the 1 day, 1 month & 1 year stock price percentage change?

What is the market cap? Describe its ranking amongst peers and percentage change over 1 and 5 years.

What was the 2018 revenue? Describe its ranking amongst peers and percentage change over 1 and 5 years.

What is the average percentage change in revenue of technology companies in the S&P 500 over the last 5 years?

Describe the news headlines.

How would you describe the performance of the stock over the short and long term?

How would you describe the stock's performance against its peers?

How do you interpret the news headlines in relation to this stock?

Please place a tick in the appropriate box

1) **I think that I would like to use this product frequently.**

Strongly disagree				Strongly agree
1	2	3	4	5

2) **I found the product unnecessarily complex.**

Strongly disagree				Strongly agree
1	2	3	4	5

3) **I thought the product was easy to use.**

Strongly disagree				Strongly agree
1	2	3	4	5

4) **I think that I would need the support of a technical person to be able to use this product.**

Strongly disagree				Strongly agree
1	2	3	4	5

5) **I found the various functions in the product were well integrated.**

Strongly disagree				Strongly agree
1	2	3	4	5

6) **I thought there was too much inconsistency in this product.**

Strongly disagree				Strongly agree
1	2	3	4	5

7) **I imagine that most people would learn to use this product very quickly.**

Strongly disagree				Strongly agree
1	2	3	4	5

8) **I found the product very awkward to use.**

Strongly disagree				Strongly agree
1	2	3	4	5

9) **I felt very confident using the product.**

Strongly disagree				Strongly agree
1	2	3	4	5

10) **I needed to learn a lot of things before I could get going with this product.**

Strongly disagree				Strongly agree
1	2	3	4	5

Appendix 2: Industry report

STATE STREET.

CONTENTS

THE PAST: DAWN OF ONLINE INVESTING

Online investing is the act of traders and investors using online services and trading platforms offered by brokers. While it has had an undoubted boom in the twenty-first century, the history and dawn of the industry stems back years.

The first web brokerage firms broke into the industry of online trading in 1994 when K. Aufhauser & Company Inc. launched their online trading platform: WealthWEB. This company was later acquired by TD Ameritrade which is today, one of the world's most popular online trading platforms. By 1999 there was more than twelve million users of these platforms as more than one-hundred and twenty e-brokerage platforms were available. This increase in users was aided by the fact commissions on trades had dropped by 50% since the initial platform had been launched in 1994, making the service much cheaper and accessible for the regular user. Other benefits drawing in new users was the fact people felt much more in control and they had greater ability to access global markets.

Users were however, inexperienced for the most part and had over confidence in online materials. This led in part to DOTCOM stocks inflating massively. Then when DELL and CISCO stock were sold in large number it caused the whole bubble to burst which caused losses of $1.7 trillion.

CURRENT TECHNOLOGIES USED TO INVEST

The primary technologies used to invest in finance at the moment are all visual. Laptops and PCs are primarily used with 162 million sold worldwide in 2018. The larger processing power of PCs was even more attractive with 260 million sold worldwide.

While investing from the office desk is still the preferred method, tablets and smartphones in today's day and age are also being used. This is a big development in recent years as before investing from the palm of your hand would have been impossible.

This allows investors to make decisions much easier and allows quicker access to the information. All of these devices heavily rely on the visual element (although smartphones do now have Voice Assistants) which shows the neglect of the audio function. This extra mode of communication has the ability to increase the personalization of an individual's investment experience. Research into information modality has shown effectiveness of providing audio and visual information in tandem with each other.

CURRENT METHODS OF INFORMATION

THE RETAIL INVESTOR

Presently, financial information comes from three different sources: Traditional intermediaries, self-diligence and social media. While the traditional intermediary was the main option for years, social media and websites providing financial info have begun to gain a foothold recently.

Traditional Intermediary: Well established sources of information. Providing a trustworthy platform to invest. Fidelity and TD Ameritrade offer financial advisors, ranging from Hedge funds to private equity.

Self-Diligence: Spawned from the creation of internet-1997. Provides overview of the general market. This valuable information is free to access to anyone with an internet connection. Offering information such as current news and price changes.

Social Media: New social platforms for investors to access information. Reddit allows you join specific investment communities where you can interact with like-minded individuals. You can follow experienced investors on Twitter or certain investment news outlets.

INSTITUTIONAL INVESTORS

What information they look at

The institutional investor views vastly different information when compared to the retail investors. These people are mainly investing on behalf of organisations and other people. While retail investors can rely on articles and social media outlets for data, an institutional investor does have access to better quality information such as company reports and years of industry experience behind them. A study completed by eFront on the reporting practices of 1,800 private market funds, found that the bigger the investor the better information they receive. This report revealed that general partners that provided standard reporting templates which contains highly detailed and granular data, had internal rates of return that were 10.2% higher that its peers.

These reporting templates are a valuable tool as they provide information on the asset manager, number of investment professionals and exposure to geographies and sectors, as well as a detailed breakdown of both fees and portfolio companies. eFront found that funds that used these standardized templates provide 70% more information than the average fund.

Institutional investors can use listed options strategies to gain an advantage. A report by Greenwich discussed how 81% of investors using this method were pleased with the performance vs major market benchmarks.

A key part of an institutional investors information search is communicating with peers. The UBS head of innovation believes ultra-high net worth clients will still be using the clients' advisor for at least the next decade, whereas, the retail sector is adapting away from this model. Investment managers like the option to speak with client advisors to voice concerns around decisions. Developing relationships with company management is a critical part of research traders for when they evaluate which firms to invest or bet against.

The 'Financial Advisor' persona is a great example of a typical institutional investor. They offer funds from the Approved Product List to their clients and rely on a high knowledge base to trusted by their clients and to build a relationship. Therefore, rich, quality information is needed by the financial advisor. The technologies they use are traditional: PC, tablet and mobile. They receive that information through PDFs, Charts, data extracts, audio, and video. These advisors take a lot of data into consideration. Smart beta, TER, ESG, MDY, ETF market share, and Thematic investing to name a few. This data is viewed in multiple formats such as Articles, Blogs, Factsheets, Fund list/profiles, Whitepapers, and News Letters.

INDUSTRY DISRUPTION

Value of Information: Costs of advanced technology reducing (smartphones) and the speed at which an individual can access information (internet). Institutions that previously held the majority of sought after financial information have had the industry disrupted by the democratization of this information. With the aforementioned social media growth, the digestion of investment information has never been easier with relevant information being so easily distributed. Deloitte's investment management outlook 2016 viewed advances in technology as a method to reduce the cost of portfolio management.

External innovation: A method of combatting this rapid shift is for these institutions to acquire new innovative FinTech businesses to integrate with the processes that exist already. This allows cheaper entry into the retail investment market that traditionally would be far too expensive to enter. A survey by Finextra of 500 global asset managers found that just over two-thirds (61%) indicated they would take an incremental approach to IT change versus re-engineering their entire tech ecosystems. Furthermore, many firms are selectively seeking tech partners as a way to gain scale given the cost involved with an architectural overhaul.

Technological Advances:

The institutional sector is rapidly changing with the advances in enabling technology. Among other areas, advanced data and analytics has become a crucial component of institutional investors' due diligence practices. As compliance-driven automation and standardization enables richer data and more powerful analytic results, due diligence

teams can break down and examine a target's tax affairs more extensively and quickly. This can significantly shorten the deal-making process and enable better decisions. A PGIM article discusses how long-term institutional investors should recognize five possible actions to reap the benefits to avoid the risks of the current wave of disruptive technology. These are: Position the portfolio for obsolescence risk, develop a framework to identify technology leaders, look beyond venture capital, evaluate how data and analytics can be used, and brace for a "techlash". While some barriers with technology exist for some institutional investors, this should only be a short-term problem with many problems that exist currently could be solved in the next 5 years.

EMERGING INVESTORS

The emerging investors of the next 5-10 years will be people born between 1980-1995. These people are now classified as millennial investors and they are a vital market in the future. In the USA alone, there are 76 million people within this demographic.

This demographic is extremely important to factor into future investing as by 2020 they will make up one third of the US population and by 2025 they will comprise three quarters of the US workforce, meaning future of investing will be dominated by them.

This generation are the first to have grown up with the internet and modern technology properly integrated into their lives. However, they show a distinct lack of social trust due to the fact many grew up during the financial crash of 2008. Institutions have been taking advantage of this lack of trust by providing alternatives to the traditional intermediaries. Examples of such innovation are Uber, AirBnB and Coinbase. This has led to new investors straying from the regular investment instruments and veering towards more innovative ways of making money. Social trading and Initial Coin offerings are just two of these new products emerging that have seen significant investment in recent years.

Disintermediated, transparent and socially responsible investments are appearing to be appealing to these millennial investors. These can come in the form of ICO investments or Environmental, Social and Governance investments. Traditional Investment Intermediaries have to adapt to the demands of these new investors.

EMERGING INVESTMENTS

ICOS

Who are the people investing: Poll by crypto finance company Circle showed that 25 percent of millennials said they are interested in purchasing digital currencies over the next 12 months, which sets them apart from other generations by more than 10 percent.

Valuation: Web browser Brave's ICO generated $35 million in less than 30 seconds. ICO value in October 2017 year-to-date (YTD) was $2.3 billion, ten times greater than calendar year 2016.

What is their appeal: It is possible to reduce the costs of capital raising, avoiding intermediaries and payment agents. Blockchain possesses the ability to replace middlemen with mathematics; this is achieved by transfer the ownership of assets directly from one party to another. The use of Cryptography makes the chances of fraud and theft almost impossible, providing a high level of security to investors.

What concerns are there: Little to no standard regulation exists over this investment area. China, South Korea among countries to outright ban ICOs. “An ICO must be conducted in a manner that promotes investor trust and confidence" - Australian market authority. Facilitated the use of Bitcoin in the WannaCry ransomware virus. The market is also extremely volatile with huge swings in price occurring regularly with no apparent reason.

Outlook: With Europe, America, and most of Asia set to increase regulation and accountability of ICOs. The future of this investment method is positive, albeit without the huge market fluctuations.

ICOS- READY FOR THE INSTITUTIONAL INVESTORS?

If the ICO market has seen so much potential for enormous profits, why hasn’t the institutional investors shown more interest?

Risk: This new method is extremely volatile and seems to swing massively without proper validation.

Regulation: As mentioned earlier, the lack of regulation and outright ban in certain countries is a huge reason for the hesitation to adopt.

Perception: Public perception views ICOs as enabling cyber-crime and as a gimmick.

Potential: Some large companies are investing in the Blockchain technology behind ICOs and betting on the market becoming more mainstream. As more companies back this technology, the greater the potential returns will be, along with an increase in public trust. Examples: Facebook, JP Morgan, Bank of America, Apple, Axa Group.

ALTERNATIVE INVESTMENTS- AN INSTITUTIONAL PERSPECTIVE

Alternative investments such as Crowdfunding, P2P lending, and ICOs have been commonly associated with the retail investors. This type of investment is, for the most part, not within the scope of institutional investors. Alternative Investments that appeal to this group include private debt/equity, and infrastructure. A report into the alternative investment sector was conducted by Prequin in 2018, based on surveys from 300 fund managers and 120 institutional investors. This report revealed this market could be worth over $14 trillion by 2023.

Their data shows that investors plan to increase their allocations to three major categories in the next five years: 79 percent said they would increase their private equity allocation, 70 percent plan to boost allocations to infrastructure, and 62 percent plan to increase allocations to private debt. Private equity assets are expected to increase by 58 percent over the next five years, overtaking hedge funds as the largest

alternative asset class, according to the report. The private debt market is expected to double in size, reaching $1.4 trillion in size by 2023, according to Preqin.

With this increase in alternative investment options, the amount of investment firms is set to grow substantially and an increased level of competition will be seen, there are expected to be more fund managers available for allocators to choose from in 2023. Preqin data show a projected 21 percent increase, bringing the total number of fund management firms to 34,000 in 2023.

Future Growth: Developing economies such as Africa and South-East Asia are set to become major markets in the alternative investment ecosystem. 84% of investors plan to increase their allocation to alternatives in the next five years. By 2020, emerging economies will likely make up over 60% of the world's GDP.46% of fund managers plan to increase their investment in Africa by 2023.

SOCIAL INFLUENCE AND PEER REFERRAL

81% of people aged 20-35 are on Facebook, where their generation's median friend count is 250. Many firms have begun to use Twitter as a form of communicating news to consumers and investors because of its appeal and focus on the 140 characters enabling people to communicate concise, valuable information. ''Wisdom of the crowds'' mind-set, potential investors can discuss openly across many different mediums to help them make a financial decision.

Social media and specialized trading websites are making the exchange industry more accessible and approachable. They are helping to simplify terms and conditions. Also, these online social communities of traders are offering support where necessary to educate their audiences. Those with minimum experience can rely heavily on people they perceive have insider knowledge on a potential investment. In 2013, one tweet from billionaire Carl Icahn was all it took to see Apple's stock soar. In fact, the stock gained $17 billion in a matter of minutes.

Reddit, a social discussion platform, has become the primary research point for many investors. The ability to discuss with like-minded individuals is a major benefit. Communities such as r/investing boasts over 700'000 active members. Social Trading has become increasingly popular as more people are influenced by what other investors are trading.

SOCIAL TRADING PLATFORMS

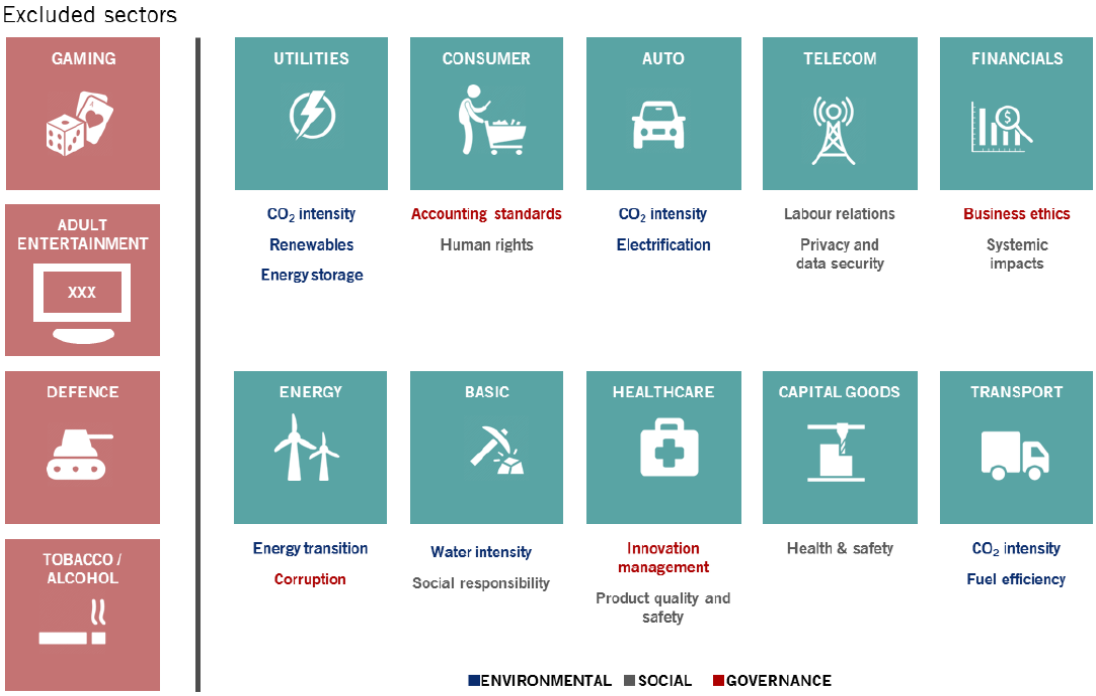
EToro: By depositing funds with the site, you can execute trades based on strategies developed by other members. Strategies include asset classes such as FX, indices, commodities, stocks, ETFs, and others. Fees are captured in the bid/ask spread rather than through a monthly payment.

Scutify: It features a scroll of posts from various members with their commentary on stocks. Post are broken up into channels and hashtags. 'Scutify Sentiment Indicator.' It allows you to quickly see the sentiment of members for a particular stock.

StockTwits: The platform integrates with Twitter, so you are getting posts from people posting on Twitter and to StockTwits. A heat map allows you to see many stocks at once. The redder the heat map, the more negative prices there are for stocks listed. You can drill down further into different groups of stocks.

ENVIRONMENTAL, SOCIAL, GOVERNANCE (ESG)

Environmental criteria consider how a company performs as a steward of nature. Social criteria examine how it manages relationships with employees, suppliers, customers, and the communities where it operates. Governance deals with a company's leadership, executive pay, audits, internal controls, and shareholder rights.



The above image describes all the sectors of business that fall under each section. Such as Human rights, Renewable Energy, and Ethics. Investors are becoming increasingly

aware of all these factors when looking to invest. For younger investors, Climate Change has become the most important ESG factor. The people investing in these products are a generation that is willing to pay more for a product if they know the investment is going to a good cause. With the massive reach social media has provided, companies must factor in massively social responsibility.

Companies have had to adapt to this demand for ESG information on the investment options they supply. In private markets, the UN Principles for Responsible Investment (PRI) reports that two out of every three LPs consider responsible investment in their selection of fund managers, while Preqin's data shows that nearly half of alternative fund managers will consider ESG principles in every investment they make by 2023. In private capital, ESG will become more polarized around "E" and "G", casting light on managing environmental and climate-related risks and governance issues. Green and specialized ESG funds will proliferate, many seeking to meet growing demand from LPs for such "clear-cut" ESG investments.

Businesses with better environmental, social and governance standards typically record stronger financial performance and beat their benchmarks, according to research from Axioma. The risk and portfolio analytics provider said the majority of portfolios weighted in favour of companies.

with better ESG scores outperformed their benchmarks by between 81 and 243 basis points in the four years to March 2018. There are strong signs that many institutional investors are making room for sustainable investments, according to a Forbes report. 81% of those surveyed have some ESG mandate as part of their formal investment policy, and 20% have sustainable private fund managers in a dedicated investment bucket.

Financial services companies such as JPMorgan Chase, Wells Fargo, and Goldman Sachs have published annual reports that extensively review their ESG approaches and the bottom-line results.

Goldman Sachs- Report in 2018. 'Green ETFs' have seen their numbers rise. From 2004-2014 only 24 were launched compared to 22 and 18 for 2016 and 2017 respectively.

JPMorgan- 2018 report. Aim to facilitate over $100bln in clean financing by 2025 and achieve 100% renewable energy usage by 2020.

Wells Fargo- 5-year goal covering diversity and social inclusion, economic empowerment, and environmental sustainability. Reported that 100% of global operational needs is met by renewable energy.

BlackRock - released an ESG report in February 2019. They discuss how sustainable investing is no longer a niche area and is becoming more mainstream for investors' portfolios.

State Street - Adapting to this need with the introduction of its R-Factor. This is State Street's internal measuring of the ESG level of investment options. They have

conducted a survey and found Sixty-seven percent of Millennials place a higher value on making an impact, and they are investing to pursue values over the long term.

FUTURE TECHNOLOGY

VOICE ASSISTANTS

In the last 5 years the prominence of voice technology has grown significantly. The market is now worth $49 billion and this figure will only rise in the future. These devices allow for increased personalisation as the system learns from your responses and takes your personal information into account. This can be applied in future to financial setting which will allow the devices to recommend stocks and shares and share relevant news stories to the user. Some of the main products on the market are:

Amazon Alexa Show:

Bloomberg, Fidelity has developed Investment apps on Alexa Show. Currently developing a POC looking at aiding financial decisions for retail Investors.

Google Home:

Ability to ask Google Home about the stock market and have it return any big news in the current financial world.

Barriers to Adoption:

Privacy Concerns: A report by PwC into the use of Voice assistants found that 38% of respondents don't want something 'listening in' on my life. With 28% concerned with issues regarding their personal data security. Voice assistants on smartphones have the lowest consumer satisfaction rate (38%) with many expressing frustrations with reliability, accuracy, and performance. In consumer homes, issues regarding child protection regulation and security breaches are the most problematic. In 2014, YELP was fined $450k for admitting they collected children's personal data without parental consent, this can happen with data collected from Voice assistants.

Perceived Benefit: The general consensus of voice assistants is they are mainly a 'gimmick' and have no major use for commercial integration. The PwC report also showed 17% of respondents do not see the benefit from voice technology. WeWork discontinued a two-month pilot that was testing Amazon Alexa for business. A state-of-voice report in 2018 found 16% only use voice technology to check the weather, 11% to listen to music, and 3% get the news through this medium.

Future Outlook:

Even though there are many barriers to mainstream Voice Assistant adoption, the future looks optimistic for the technology.

The advantages of voice- A survey by UberAll found 48% of U.S SMB marketers say Alexa has the most potential among voice assistants. One in four marketers believe voice marketing will be valuable to their businesses.

ROBO-ADVISORY

Robo-advisory is another future technology sure to have a huge impact on the future of investing. Robot-Advisory allows the investor to interact with a system instead of a person, which then offers advice based on parameters entered. Mainly deals in the ETF Market. This market is worth $1bln, with potential to grow over $2.5bln by 2023. As Artificial Intelligence (AI) continues to become smarter, these recommendations will increase in accuracy. People will trust these Robo-advisors more and use traditional financial services less. Some companies have countered this by creating their own Robo-advisor.

Schaub Intelligent Portfolios- Min. of $5,000 to start. No commission.

Betterment Robo-Advisors. $15lbm AUM, 40,000 users.

Wealth Front Advisor. Suited for young investors due to $500 min investment.

VIRTUAL AUGMENTED REALITY

Virtual Reality has seen significant growth in the entertainment sector, such as video games and providing a safe virtual environment for doctors, engineers, and architects. This industry is still very immature for use in the financial sector, specifically for trading.

Concerns: A major issue is the price of a system with one Oculus Rift costing $400, leading to limited adoption. Investors have been accustomed to viewing information on a screen or physical sheet, it will take some time for the idea of a virtual environment to become mainstream.

Future: Some features of everyday office life, such as Microsoft excel have been visualized. However, State Street is examining the viability of this technology as an aid in finance, using it to tackle the problem of data literacy.

IN CONCLUSION

The information presented in this report has explored the vast topic: The Future of Investing. Viewing the landscape in 5-10 years, all aspects were explored. Ranging from who will be the investors of the future, what they will be investing in, and how will they invest. The main takeaways from this report are:

Investors no longer see ESG investment as a ‘nice-to-have’: The majority of investors now expect to see ESG information when making their investment decision. The Environmental aspect of investing is the largest sector with the rise of protests and demonstrations demanding decision makers take rapid action. In the next 5-10 years, this trend is only set to exponentially increase.

Social Influence and Peer-Referral is playing a larger role: With the emergence of social media, the information gap between institutional and retail investors has decreased substantially. This access to investment information has drawn inexperienced investors which has helped spawn Social trading. Sites such as Etoro will continue to expand. Institutions still provide much richer information for decision-making and will continue to own a large market share. However, these institutions would benefit from inserting themselves into the investment process of these inexperienced investors.

Alternative Investments are set to exponentially grow: Equity/private debt, etc. are expected to become a major investment option in the next 5-10 years. Particularly for emerging economies which are set to take 60% of the world's GDP by 2023. Current institutions would benefit from exploring this market further and capitalizing on this opportunity.

Some Technologies are here, some still have a way to go: For investors, technology such as Voice Assistant Interaction (Alexa, Siri) are being integrated into the information search with the ability to personalize for each investor being a major advantage. AI/Robot-Advisory is already an established sector and positive growth signs. Virtual Reality use for investing is still at the infantile stage with current R&D projects exploring the use-cases. In the future, this technology may be available for investment decision making, but not in the current state.

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Trends that will shape future of Investing
KPMG Investing in the Future Report
Deloitte Industry Disruption Report
Prequin Alternative Investment report
Alternative Investment Industry Report
Child protection Voice assistants
Amazons marketing potential
Alexa for Enterprise
PwC report on Voice assistants
State of voice report
How option backdating offers inst. investors an advantage
Benefits of Transparency Inst. Investing
JPMorgan Report

Appendix 3: Presentation

Todays Presentation

Research Purpose: Over the timeframe of the next 5 to 10 years, in what way will new technology impact on how investors make financial decisions?

How will they want to receive information, through which medium, and how can technology personalize the presentation of the data which they base their decisions on?

CORK UNIVERSITY BUSINESS SCHOOL

STATE STREET

STATE STREET GLOBAL ADVISORS

Industry report

Examined the state-of-play and future trends for the investment ecosystem

Key Findings:

- ESG investing growth
- Investor decision making trends
- Alternative Investment development
- Emerging technology

Academic Research

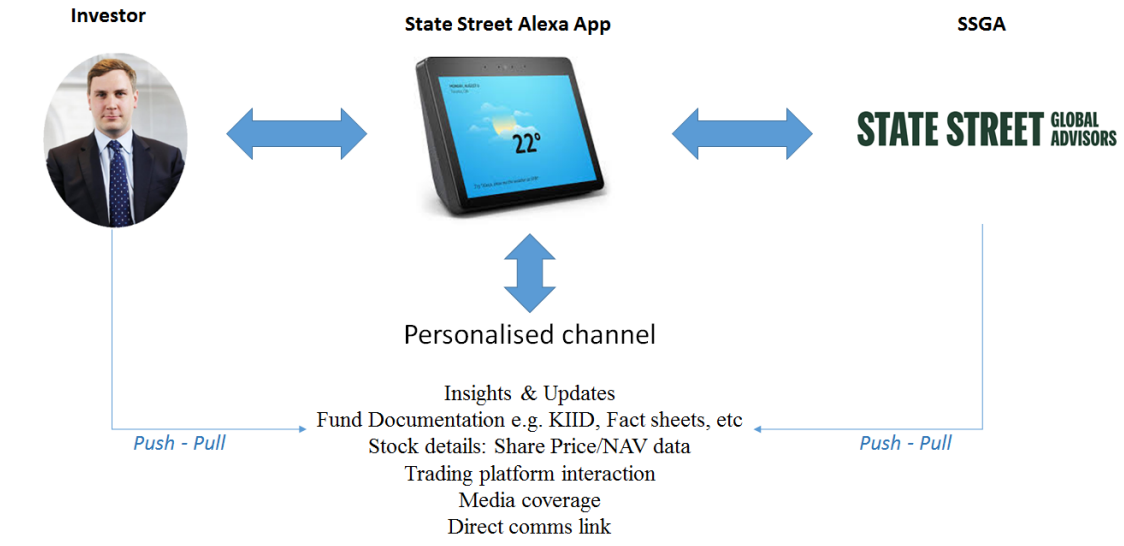
Focused on 2 research questions:

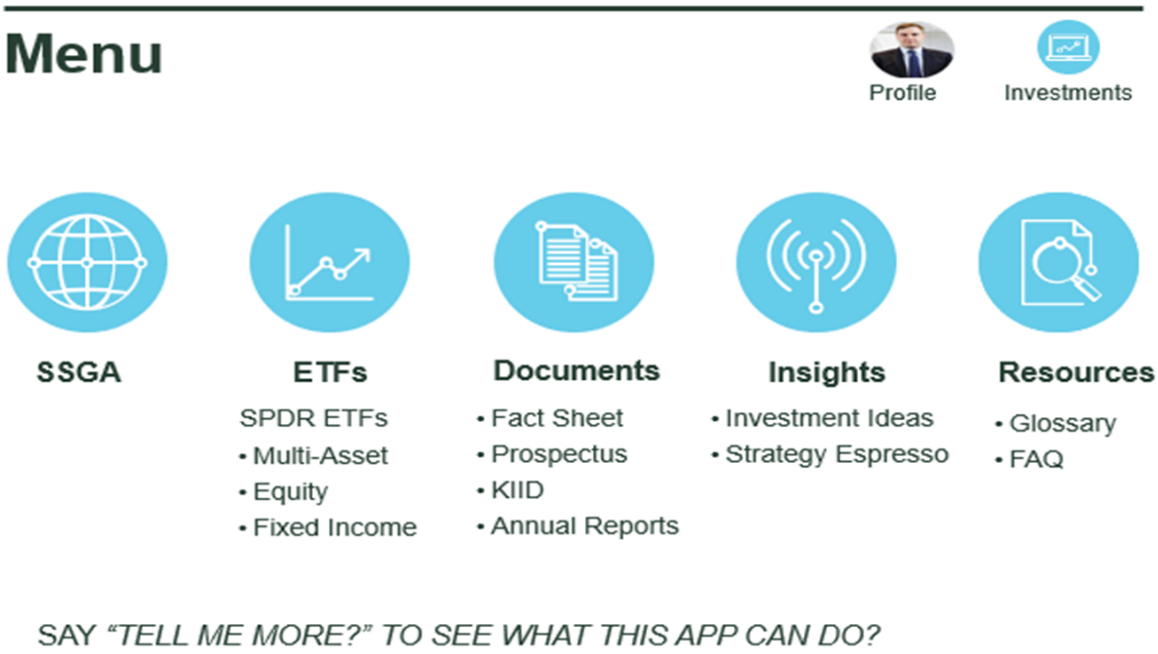
- In what way will new technology impact on how investors make financial decisions?
- Explore the impact of peer influence and social media on the decision making of investors of the future

Overall findings

- Voice and audio systems such as Amazon Alexa have the potential to create new or augment existing distribution channels.
- ESG and Equity/Private Debt investing continuing to grow.
- Combination of Audio/Visual information enables better investor decision making.

Amazon showcase





ETFs

Equity ETFs:

IE	SPDR® MSCI USA Value UCITS ETF	ZPRU GY^	31-08-2019	-3.85%	6.13%	10.45%	-7.38%	7.40%	-	5.55%	0.25%	18/02/2015
IE	SPDR® Russell 2000 U.S. Small Cap UCITS ETF (Acc)	ZPRR GY^	31-08-2019	-4.96%	2.41%	11.58%	-13.16%	7.40%	6.23%	5.59%	0.30%	30/06/2014
IE	SPDR® S&P® 400 U.S. Mid Cap UCITS ETF (Acc)	SPY4 GY^	31-08-2019	-4.23%	4.22%	13.98%	-6.92%	7.44%	6.60%	10.70%	0.30%	30/01/2012
IE	SPDR® S&P® 500 EUR Hdg UCITS ETF (Acc)	SPPE GY^	-	-	-	-	-	-	-	-	0.12%	31/10/2018
IE	SPDR® S&P® 500 Low Volatility UCITS ETF (Acc)	SPY1 GY^	31-08-2019	2.35%	7.18%	23.04%	15.85%	12.43%	11.80%	12.57%	0.35%	03/10/2012
IE	SPDR® S&P® 500 UCITS ETF (Dist)	SPY5 GY^	31-08-2019	-1.63%	6.76%	17.99%	2.51%	12.27%	9.67%	12.14%	0.09%	19/03/2012
IE	SPDR® S&P® Euro Dividend Aristocrats UCITS ETF (Dist)	SPYW GY^	31-08-2019	-0.55%	0.83%	11.28%	1.48%	5.79%	6.58%	9.15%	0.30%	28/02/2012

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SSGA Alexa

This KIID has been sent to your device.

STATE STREET GLOBAL ADVISORS.

Fund Name:

SPDR S&P 500 ETF

Price:

$298.09

Amount:

3,355

Date of Purchase:

16/09/2019

Date of Settlement:

20/09/2020

STATE STREET GLOBAL ADVISORS.

SSGA Alexa Skill

You have successfully purchased €1 million worth of S and P 500 SPDR ETF

STATE STREET GLOBAL ADVISORS.

Profile:

Name: Jonathon Smith

Job Title: Private Wealth Management,
Independent Wealth Manager, Financial Advisor

Goals: Provide an outstanding end-to-end client experience which ensures we have long lasting partnerships with our clients

Clients Managed: ABC Ltd.
XYX Ltd.
Amnesty Fiance Company

Interested In: Low Cost ETFs
ESG
ETF Flows

Relevant Funds: SPDR S&P 500 ETF
SPDR MSCI EM Asia UCITS ETF
SSGA GBP Liquidity Fund

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